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1911 Edwards, F. W., *Kingswear, Cornwall-road, Harrow.*
1886 Edwards, James, *Colesborne, Cheltenham.*
1884 Edwards, Stanley, F.L.S., F.Z.S., (Council, 1912–14), 15, *St. Germans-place, Blackheath*, S.E.
1913 Edwards, William H., *Natural History Dept., The Museum, Birmingham.*
1900 Elliott, E. A., 16, *Belsize Grove, Hampstead*, N.W.
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1886 Ellis, John W., M.B., L.R.C.P., 18, *Rodney-street, Liverpool.*
1903 Eltringham, Harry, M.A., D.Sc., F.Z.S., (V.-Pres., 1914; Council, 1913–), *Woodhouse, Stroud, Gloucestershire*; and *Hope Department, University Museum, Oxford.*
1878 Elwes, Henry John, J.P., F.R.S., F.L.S., F.Z.S., (Pres., 1893–4; V.-Pres., 1889–90, 1892, 1895; Council, 1888–90), *Colesborne, Cheltenham.*
1914 Emmett, Lieut. Charles P., c/o Messrs. Cox & Co., 16, *Charing Cross*, W.C.
1886 Enock, Frederick, F.L.S., 54, *St. Mary's-terrace, West Hill, Hastings.*
1903 Etheridge, Robert, *Curator, Australian Museum, Sydney, N.S.W.*
1908 Eustace, Eustace Mallabone, M.A., *Challacombe, Crowthorne, Berks.*
1909 Evans, Frank J., Superintendent of Agriculture, *Calabar, Eastern Province, S. Nigeria.*

1907 Feather, Walter, 10, *Station-grove, Crosshills, near Keighley, Yorks.*
1900 Feltham, H. L. L., *P. O. Box* 46, *Johannesburg, Transvaal.*
1861 Fenn, Charles, *Erersdon House, Burnt Ash Hill, Lee*, S.E.
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1889 Fernald, Prof. C. H., *Amherst, Mass., U.S.A.*

1900 Firth, J. Digby, F.L.S., *Boys' Modern School, Leeds.*
1905 Fleet, Wilfred James, F.H.A.S., F.C.S., *Imatra, King's-road, Bournemouth.*
1900 Flemyng, The Rev. Canon W. Westropp, M.A., *Coolfin, Portlaw, co. Waterford.*
1898 Fletcher, T. Bainbrigge, R.N., *Agricultural Research Institute, Pusa, Bihar, India.*
1883 † Fletcher, William Holland B., M.A., *Aldwick Manor, Bognor.*
1905 Floersheim, Cecil, 16, *Kensington Court Mansions,* S.W.
1885 Fokker, A. J. F., *Zierikzee, Zeeland, Netherlands.*
1914 Fordham, William John, M.R.C.S., L.R.C.P., *The Villa, Bubwith, Selby, Yorks.*
1913 Foster, Arthur H., M.R.C.S., L.R.C.P.(Eng.), M.B.O.U., *Sussex House, Hitchin, Herts.*
1900 Foulkes, P. Hedworth, B.Sc., *Harper-Adams Agricultural College, Newport, Salop.*
1898 Fountaine, Miss Margaret, *Myola,* via *Cairns, N. Queensland, Australia.*
1880 Fowler, The Rev. Canon, D.Sc., M.A., F.L.S., (Pres., 1901–2; V.-Pres., 1903; Sec., 1886–96), *Earley Vicarage, near Reading.*
1908 Fraser, Frederick C., Capt., M.D., I.M.S., c/o The Ent. Soc. of London.
1896 Freke, Percy Evans, *Southpoint, Limes-road, Folkestone.*
1888 Fremlin, H. Stuart, M.R.C.S., L.R.C.P., 1st London Sanitary Co., Duke of York's Headquarters, *Chelsea,* and *The Elms, Kingsbury,* N.W.
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1906 † Fry, Harold Armstrong, *P.O. Box* 46, *Johannesburg, Transvaal Colony.*
1900 Fryer, H. Fortescue, *The Priory, Chatteris, Cambs.*
1907 Fryer, John Claud Fortescue, M.A., *Board of Agriculture and Fisheries, Craven House, Northumberland-avenue,* W.C.
1876 Fuller, The Rev. Alfred, M.A., *The Lodge,* 7, *Sydenham-hill, Sydenham,* S.E.
1898 Fuller, Claude, Government Entomologist, *Pietermaritzburg, Natal.*

1887 Gahan, Charles Joseph, M.A., D.Sc., (Sec., 1899–1900; Council, 1893–5, 1901, 1914–), 8, *Lonsdale-road, Bedford Park,* W.; and *British Museum* (*Natural History*), *Cromwell-road,* S.W.
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1890 Gardner, John, *Laurel Lodge, Hart, West Hartlepool.*
1901 † Gardner, Willoughby, F.L.S., *Deganwy, N. Wales.*
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1899 Geldart, William Martin, M.A., 10, *Chadlington-road, Oxford.*

1913 Gibb, Lachlan, 38, *Blackheath Park, Blackheath, S.E.*
1906 † Gibbs, Arthur Ernest, F.L.S., F.Z.S., (Council, 1912–14), *Hounds-path, Upper Marlborough-road, St. Albans.*
1915 Gibson, Arthur, *Entomological Branch, Dept. of Agriculture, Ottawa, Canada.*
1908 Giffard, Walter M., *P.O. Box* 308, *Honolulu, Hawaii.*
1907 Giles, Henry Murray, Head Keeper of Zoological Gardens, *South Perth, W. Australia.*
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1904 Gilliat, Francis, B.A., *Combe House, Balcombe, Sussex.*
1914 Godfrey, E. J., Education Dept., *Bangkok, Siam.*
1865 † Godman, Frederick Du Cane, D.C.L., F.R.S., F.L.S., F.Z.S., (Pres., 1891–2 ; V.-Pres., 1882-3, 1886, 1889–90, 1902 ; Council, 1880–1, 1900), *South Lodge, Lower Beeding, Horsham* ; and 45, *Pont-street*, S.W.
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1898 Gordon, J. G. McH., *Corsemalzie, Whauphill S.O., Wigtownshire.*
1898 Gordon, R. S. G. McH., *Corsemalzie, Whauphill S.O., Wigtown-shire.*
1855 Gorham, The Rev. Henry Stephen, F.Z.S., (Council, 1882–3), *High-croft, Great Malvern.*
1913 Gough, Lewis, Ph.D., Entomologist to the Govt. of Egypt, *Dept. of Agriculture, Cairo.*
1909 Gowdey, Carlton C., B.Sc., c/o Dr. A. Gowdey, *The Grange, Maitland Park, Haverstock Hill*, N.W.
1914 Graveley, F. H., *The Indian Museum, Calcutta.*
1911 Graves, P. P., *Turf Club, Cairo, Egypt.*
1891 † Green, E. Ernest, F.Z.S., Vice-President, (Council, 1914–), *Way's End, Beech avenue, Camberley.*
1910 Green, Herbert A., *The Central Fire Station, Durban, Natal.*
1894 Green, J. F., F.Z.S., 38, *Pont-street, London, S.W.*
1893 † Greenwood, Henry Powys, F.L.S., *Whitsbury House, Salisbury.*
1888 Griffiths, G. C., F.Z.S., *Penhurst, 3, Leigh-road, Clifton, Bristol.*
1894 Grimshaw, Percy H., *Royal Scottish Museum, Edinburgh.*
1905 Grist, Charles J., *Elgin House, Knockholt, Sevenoaks.*
1906 Gurney, Gerard H., *Keswick Hall, Norwich.*
1910 Gurney, William B., Asst. Govt. Entomologist, *Department of Agriculture, Sydney, Australia.*

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1906 Hall, Arthur, 7, *Park-lane-mansions, Croydon.*
1890 † Hall, Albert Ernest, *Cranfield House, Southwell, Notts.*
1885 Hall, Thomas William, *Stanhope, The Crescent, Croydon.*
1912 Hallett, Howard Mountjoy, 64, *Westbourne-road, Penarth, Glamorganshire.*

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1915 Hamm, Albert Harry, 22, *Southfield-road, Oxford.*
1891 Hampson, Sir George Francis, Bart., B.A., F.Z.S., (V.-Pres., 1898 ; Council, 1896–8), 62, *Stanhope-gardens*, S.W.
1891 Hanbury, Frederick J., F.L.S., *Brockhurst, E. Grinstead.*
1905 † Hancock, Joseph L., 5454, *University-avenue, Chicago, U.S.A.*
1903 Hare, E. J., 4, *New-square, Lincoln's Inn*, W.C.
1904 Harris, Edward, *St. Conan's, Chingford, Essex.*
1910 Harwood, Philip, 23, *Northgate End, Bishop's Stortford.*
1910 Hawkshaw, J. C., *Hollycombe, Sussex.*
1913 † Hawkshaw, Oliver, 3, *Hill-street, Mayfair*, W.
1910 Hedges, Alfred van der, *Stoke House, Stoke Mandeville, Bucks.*
1910 Henderson, J., c/o Messrs. Osborne & Chappel, *Ipoh, Perak, Federated Malay States.*
1898 Heron, Francis A., B.A., 9, *Park House, Highbury Park*, N.
1903 Herrod-Hempsall, William, *W.B.C. Apiary, Old Bedford-road, Luton, Beds.*
1908 Hewitt, C. Gordon, D.Sc., Dominion Entomologist, *Dept. of Agriculture, Ottawa, Canada.*
1913 Hewitt, John, B.A., Director, *Albany Museum, Grahamstown, S. Africa.*
1913 Hill, Gerald F., Govt. Entomologist, *Port Darwin, Northern Territory, South Australia.*
1876 † Hillman, Thomas Stanton, *Eastgate-street, Lewes.*
1907 Hoar, Thomas Frank Partridge, *Mercia, Albany-road, Leighton Buzzard.*
1914 Hodge, The Rev. Prebendary Edward Grose, *The Vicarage, Paddington.*
1912 Hodge, Harold, *St. James' Mansions*, 54, *Piccadilly*, W.
1888 Hodson, The Rev. J. H., B.A., B.D., *Rhyddington, Clifton Drive, Lytham.*
1902 Hole, R. S., c/o Messrs. King and Co., *Bombay.*
1910 Holford, H. O., *Elstead Lodge, Godalming, Surrey.*
1887 Holland, The Rev. W. J., D.D., Ph.D., *5th Avenue, Pittsburg, Penn., U.S.A.*
1898 Holman-Hunt, C. B., Asst. Entomologist, Department of Agriculture, *Kuala Lumpur, Federated Malay States.*
1910 Holmes, Edward Morrell, *Ruthven, Sevenoaks.*
1901 Hopson, Montagu F., L.D.S., R.C.S.Eng., F.L.S., 64, *Harley-street*, W.
1897 Horne, Arthur, 60, *Gladstone-place, Aberdeen.*
1903 Houghton, J. T., 1, *Portland-place, Worksop.*
1907 † Howard, C. W., Entomological Division, *College of Agriculture, St. Anthony Park, Minn., U.S.A.*
1900 Howes, W. George, 432, *George-street, Dunedin, New Zealand.*
1907 Howlett, Frank M., M.A., *Wymondham, Norfolk.*

1865 † Hudd, A. E., 108, *Pembroke-road, Clifton, Bristol.*
1888 Hudson, George Vernon, *Hill View, Karori, Wellington, New Zealand.*
1914 Hudson, H. Baldwin, *The Ferns, Upper Highway, Kings Langley, Herts.*
1907 Hughes, C. N., 3, *Wyndham Place, Bryanston-square,* W.
1912 Huie, Miss Lily, *Hollywood, Colinton-road, Edinburgh.*

1897 Image, Prof. Selwyn, M.A., (Council, 1909–11), 20, *Fitzroy-street, Fitzroy-square,* W.
1912 † Imms, A. D., D.Sc., B.A., F.L.S., *Entomological Dept., The University, Manchester.*
1908 Irby, Major Leonard Paul, *Evington-place, Ashford, Kent.*
1891 Isabell, The Rev. John, *Sunnycroft, St. Sennen S.O., Cornwall.*

1907 Jack, Rupert Wellstood, Government Entomologist, Department of Agriculture, *Salisbury, Rhodesia.*
1907 Jackson, P. H., 112, *Balham-park-road,* S.W.
1907 Jacobi, Professor A., Ph.D., Director of the R. Zoological and Anthrop.-Ethnographical Museum, *Dresden, Saxony.*
1911 Jacobs, Capt. J. J., R.E., *Framsden, Tring, Herts.*
1910 Jacobs, Lionel L., *P.O. Box* 445, *Sault Ste. Marie, Ontario, Canada.*
1914 Jannings, Rev. Frederic S. F., *Warmsworth Rectory, Doncaster.*
1914 Janse, A. J. T., 1*st-street, Gezina, Pretoria, S. Africa.*
1869 Janson, Oliver E., *Cestria, Claremont-road, Highgate,* N.; and 44, *Great Russell-street, Bloomsbury,* W.C.
1898 Janson, Oliver J., *Cestria, Claremont-road, Highgate,* N.
1912 Jardine, Nigel K., *Le Syndicat des Fabricants de Sucre, L'Isle de Réunion.*
1912 Jemmett, C., *Withersdane House, Wye, Kent.*
1886 Jenner, James Herbert Augustus, *East Gate House, Lewes.*
1899 Jennings, F. B., 152, *Silver-street, Upper Edmonton,* N.
1909 Jepson, Frank P., *Department of Agriculture, Suva, Fiji Islands.*
1886 John, Evan, *Llantrisant S.O., Glamorganshire.*
1907 Johnson, Charles Fielding, *West Bank, Didsbury-road, Heaton Mersey.*
1889 Johnson, The Rev. W. F., M.A., *Acton Rectory, Poyntz Pass, co. Armagh.*
1908 Joicey, James J., *The Hill, Witley, Surrey.*
1888 Jones, Albert H., Treasurer, 1904– , (V.-Pres., 1912, Council, 1898–1900), *Shrublands, Eltham,* S.E.
1894 † Jordan, Dr. K., (V.-Pres., 1909; Council, 1909–11), *The Museum, Tring.*
1910 Joseph, E. G., 23, *Clanricarde-gardens,* W.
1910 Joy, Ernest Cooper, *Eversley, Dale-road, Purley.*
1902 Joy, Norman H., M.R.C.S., L.R.C.P., *Bradfield, Reading.*
1913 Junk, Wilhelm, 68, *Sachsische-strasse, Berlin,* W. 15.

1876 † Kay, John Dunning, *Leeds.*

1896 † Kaye, William James, (Council, 1906–8), *Caracas, Ditton Hill, Surbiton.*

1907 Kelly, Albert Ernest McClure, Division of Entomology, Department of Agriculture, *Pretoria, S. Africa.*

1890 Kenrick, Sir George H., *Whetstone, Somerset-road, Edgbaston, Birmingham.*

1904 Kershaw, G. Bertram, *Ingleside, West Wickham, Kent.*

1906 Keynes, John Neville, M.A., D.Sc., 6, *Harvey-road, Cambridge.*

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1911 Khunan, Kunui, M.A., Asst. Entomologist to the Govt. of Mysore, *Bangalore, South India.*

1912 King, Harold H., Govt. Entomologist, *Gordon College, Khartoum, Sudan.*

1889 King, James J. F.-X., 1, *Athole Gardens-terrace, Kelvinside, Glasgow.*

1913 Kirby, W. Egmont, M.D., *Hilden*, 46, *Sutton Court-road, Chiswick, W.*

1889 Klapálek, Professor Franz, *Karlín* 263, *Prague, Bohemia.*

1887 † Klein, Sydney T., F.L.S., F.R.A.S., *Hatherlow, Raglan-road, Reigate.*

1910 Lakin, C. Ernest, M.D., F.R.C.S., 2, *Park-crescent, Portland-place*, W.

1911 † Lamborn, W. A., M.R.C.S., L.R.C.P., *Zomba, Nyasaland, E. Africa.*

1868 Lang, Colonel A. M., C.B., R.E., *Box Grove Lodge, Guildford.*

1912 Latour, Cyril Engelhart, *Port of Spain, Trinidad, British West Indies.*

1895 Latter, Oswald H., M.A., *Charterhouse, Godalming.*

1899 Lea, Arthur M., Government Entomologist, *Museum, Adelaide, S. Australia.*

1914 Leechman, Alleyne, M.A., F.L.S., F.C.S., *Corpus Christi College, Oxford;* and *St. Hubert's, Main-street, Georgetown, British Guiana.*

1910 Leigh, H. S., *The University, Manchester.*

1909 Leigh-Clare, Reginald L., *Golf Club, Hadley, Barnet.*

1900 Leigh-Phillips, Rev. W. J., *Burtle Vicarage, Bridgwater.*

1903 † Levett, The Rev. Thomas Prinsep, *Frenchgate, Richmond, Yorks.*

1876 Lewis, George, F.L.S., (Council, 1878, 1884), 30, *Shorncliffe-road, Folkestone.*

1908 † Lewis, John Spedan, *Grove Farm, Greenford Green, South Harrow;* and 277, *Oxford-street*, W.

1892 Lightfoot, R. M., *Bree-st., Cape Town, Cape of Good Hope.*

1914 Lister, J. J., *St. John's College, Cambridge;* and *Merton House, Grantchester.*

1903 Littler, Frank M., *Box* 114, *P.O., Launceston, Tasmania.*

1865 † Llewelyn, Sir John Talbot Dillwyn, Bart., M.A., F.L.S., *Penllergare, Swansea.*
1881 † Lloyd, Alfred, F.C.S., *The Dome, Bognor.*
1885 † Lloyd, Robert Wylie, (Council, 1900–1), I, 5 and 6, *Albany, Piccadilly*, W.
1903 Lofthouse, Thomas Ashton, *The Croft, Linthorpe, Middlesbrough.*
1908 Longsdon, D., *The Flower House, Southend, Catford*, S.E.
1904 † Longstaff, George Blundell, M.A., M.D., Vice-President, (V.-Pres., 1909; Council, 1907–9, 1915–), *Highlands, Putney Heath*, S.W.
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1893 Lower, Oswald B., *Argent-street, Broken Hill, New South Wales.*
1901 Lower, Rupert S., *Argent-street, Broken Hill, N.S.W.*
1909 Lucas, Dr. T. P., *Wakefield-buildings, Adelaide-street, Brisbane, Australia.*
1898 Lucas, William John, B.A., (Council, 1904–6), 28, *Knight's Park, Kingston-on-Thames.*
1880 Lupton, Henry, *Courtlands, Chelston, Torquay.*
1903 Lyell, G., *Gisborne, Victoria, Australia.*
1912 Lyle, George Trevor, *Bank House, Brockenhurst.*
1909 Lyon, Francis Hamilton, 89, *Clarence Gate-gardens, Upper Baker-street*, N.W.

1887 M'Dougall, James Thomas, *Dunolly, Morden-road, Blackheath*, S.E.
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1900 Mackwood, The Hon. F. M., M.L.C., *Colombo, Ceylon.*
1899 † Main, Hugh, B.Sc., (Council, 1908–10), *Almondale, Buckingham-road, South Woodford*, N.E.
1914 Mallock, J. Russell, State Entomologist's Office, *Urbana, Illinois, U.S.A.*
1905 Mally, Charles Wm., M.Sc., *Dept. of Agriculture, Cape Town, S. Africa.*
1887 * Manders, Col. Neville, A.M.S., D.D.M.S., F.Z.S., *Army of Occupation Headquarters, Cairo, Egypt.*
1892 Mansbridge, William, 4, *Norwich-road, Wavertree, Liverpool.*
1894 † Marshall, Alick, 18, *Hazeldene-road, Chiswick, W.*
1895 Marshall, Guy Anstruther Knox, F.Z.S., (Council, 1907–8), 6, *Chester-place, Hyde Park-square*, W.
1896 Marshall, P., M.A., B.Sc., F.G.S., *University School of Mines, Dunedin, New Zealand.*
1856 † Marshall, William, V.M.H., F.R.H.S., *Auchinraith, Bexley S.O., Kent.*
1897 Martineau, Alfred H., 54, *Holly-lane, W. Smethwick.*

1910 † Mason, C. W., *St. Denis, Shaftesbury, Dorset.*
1913 Mason, Lowell, 22 and 23, *Club Arcade, Durban, Natal.*
1895 Massey, Herbert, *Ivy-Lea, Burnage, Didsbury, Manchester.*
1865 Mathew, Gervase F., F.L.S., Paymaster-in-chief, R.N., (Council, 1887), *Lee House, Dovercourt, Harwich.*
1887 Matthews, Coryndon, *Stentaway, Plymstock, S. Devon.*
1912 Maulik, Samarenda, c/o Messrs. T. Cook & Son, *Ludgate-circus*, E.C. ; and *Fitzwilliam Hall, Cambridge.*
1900 Maxwell-Lefroy, H., *Imperial College of Science and Technology, South Kensington*, S.W.
1904 Meade-Waldo, Geoffrey, M.A., (Council, 1914–), *Edenbridge, Kent ; British Museum (Natural History), Cromwell-road*, S.W., and *Hever Warren.*
1913 Meaden, Louis, *Melbourne, Dyke-road, Preston, Brighton.*
1872 * Meldola, Professor Raphael, Hon. D.Sc. Oxon, Hon. LL.D. St. Andrews, F.R.S., F.C.S., F.I.C., F.R.A.S., etc. (Pres., 1895–6 ; V.-Pres., 1881, 1884, 1897, 1903, 1908 ; Sec., 1876–80 ; Council, 1874–5, 1884–5, 1889–92, 1903, 1907–8), 6, *Brunswick-square*, W.C.
1885 Melvill, James Cosmo, M.A., F.L.S., *Meole Brace Hall, Shrewsbury.*
1914 Menon, J. R., B.A., *Trichur, Cochin State, S. India.*
1887 Merrifield, Frederic, (Pres., 1905–6 ; V.-Pres., 1893, 1907 ; Sec., 1897–8 ; Council, 1894, 1899), 14, *Clifton-terrace, Brighton.*
1905 Merry, Rev. W. Mansell, M.A., *St. Michael's, Oxford.*
1912 Metcalfe, Rev. J. W., *The Vicarage, Ottery St. Mary, Devon.*
1880 Meyrick, Edward, B.A., F.R.S., F.Z.S., *Thornhanger, Marlborough.*
1894 Miall, Louis Compton, F.R.S., (Council, 1903, 1908), *Norton Way N., Letchworth.*
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1913 Miller, F. V. Bruce, *Livingston, N. Rhodesia, Africa.*
1905 Mitford, Robert Sidney, C.B., *Thornlea, Weybridge.*
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1889 † Morice, The Rev. F. D., M.A., Fellow of Queen's College, Oxford, (Pres., 1911, 1912, V.-Pres., 1902, 1904, 1913 ; Council, 1902–4), *Brunswick, Mount Hermon, Woking.*
1895 † Morley, Claude, F.Z.S., *Monk Soham House, Suffolk.*
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1907 Mortimer, Charles H., *Royton Chase, Byfleet, Surrey.*
1893 Morton, Kenneth J., 13, *Blackford-road, Edinburgh.*

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1907 † Moulton, John C., *Sarawak Museum, Sarawak.*
1911 Mounsey, J. Jackson, 24, *Glencairn-crescent, Edinburgh.*
1901 † Muir, Frederick, *H.S.P.A. Experiment Station, Honolulu, Oahu, H.T.*
1912 † Mullan, Jal Phirozshah, M.A., F.L.S., F.Z.S., Professor of Biology, *St. Xavier's College, Lamington-road, Great Road Post, Bombay, India.*
1869 † Müller, Albert, F.R.G.S., (Council, 1872–3), c/o Herr A. Müller-Mechel, *Grenzacherstrasse* 60, *Basle, Switzerland.*
1914 Murray, George W., *Dirimu Estate, Binaturi River, Daru, Papua.*
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1913 Newman, Leslie John William, *Bernard-street, Claremont, W. Australia.*
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1890 Newstead, Robert, M.Sc., A.L.S., Hon. F.R.H.S., Dutton Memorial Professor of Entomology, *The School of Tropical Medicine, University of Liverpool.*
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1878 Nottidge, Thomas, *Ashford, Kent.*
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1877 Oberthür, René, *Rennes (Ille-et-Vilaine), France.*
1893 † Ogle, Bertram S., *Steeple Aston, Oxfordshire.*
1910 Oldaker, Francis A., M.A., *The Red House, Haslemere.*
1913 Ormiston, Walter, *Kalupahani, Haldumulle, Ceylon.*

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1912 Paterson, Edward J., *Fairholme, Crowborough.*
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1915 Peile, Major Harry Diamond, I.M.S., *Bannu, N.W.F.P., India.*

1914 Pendlebury, Wm. J. von Monté, *Broadlands, Shrewsbury,* and *Keble College, Oxford.*

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1903 † Perkins, R. C. L., M.A., D.Sc., F.Z.S., *Park Hill House, Paignton, Devon;* and Board of Agriculture, Division of Entomology, *Honolulu, Hawaii.*

1879 Perkins, Vincent Robert, *Wotton-under-Edge.*

1907 † Perrins, J. A. D., 3rd Seaforth Highlanders, *Davenham, Malvern.*

1897 Phillips, Capt. Hubert C., M.R.C.S., L.S.A., 37, *Princes-square, Bayswater,* W.

1903 † Phillips, Montagu A., F.R.G.S., F.Z.S., *Devonshire House Preparatory School, Reigate.*

1891 Pierce, Frank Nelson, 1, *The Elms, Dingle, Liverpool.*

1903 Pilcher, Colonel Jesse George, I.M.S., F.R.C.S., 133, *Gloucester-road, Kensington,* S.W.

1913 Platt, Ernest Edward, 403, *Essenwood-road, Durban, Natal.*

1885 Poll, J. R. H. Neerwort van der, *Driebergen, Netherlands.*

1870 † Porritt, Geo. T., F.L.S., (Council, 1887), *Elm Lea, Dalton, Huddersfield.*

1913 Porter, Prof. Carlos, C.M.Z.S., Professor of Zoology, *Agricultural Institute, Santiago, Chile.*

1884 † Poulton, Professor Edward B., D.Sc., M.A., F.R.S., F.L.S., F.G.S., F.Z.S., Hope Professor of Zoology in the University of Oxford, (Pres., 1903–4; V.-Pres., 1894–5, 1902, 1905; Council, 1886–8, 1892, 1896, 1905–7), *Wykeham House, Banbury-road, Oxford.*

1905 Powell, Harold, 7, *Rue Mireille, Hyères (Var), France.*

1908 Pratt, William B., 10, *Lion Gate Gardens, Richmond, Surrey.*

1878 Price, David, 48, *West-street, Horsham.*

1908 Prideaux, Robert M., *Woodlands, Brasted Chart, Sevenoaks.*

1904 Priske, Richard A. R., 9, *Melbourne Avenue, West Ealing.*

1893 Prout, Louis Beethoven, (Council, 1905–7), 84, *Albert-road, Dalston,* N.E.

1910 Punnett, Professor Reginald Crundall, M.A., *Caius College, Cambridge.*

1900 Rainbow, William J., *The Australian Museum, Sydney, N.S.W.*

1912 Rait-Smith, W., *Abertillery, Monmouthshire.*

1913 Rao, H. Ananthaswamy, *Curator of the Government Museum, Bangalore, India.*

1907 Rayward, Arthur Leslie, *Rockford, Beechwood-road, Sanderstead.*

1898 Relton, R. H., c/o Perkins and Co., Ltd., *Brisbane, Queensland.*

1898 Reuter, Professor Enzio, *Helsingfors, Finland.*

1910 de Rhé-Philipe, G. W. V., c/o Grindlay & Co., *Hastings-street, Calcutta.*

1912 Riley, Norman Denbigh, 94, *Drakefield-road, Upper Tooting,* S.W.; and *British Museum (Natural History), S. Kensington,* S.W.

1908 Rippon, Claude, M.A., 28, *Walton-street, Oxford.*
1905 Robinson, Herbert C., *Curator of State Museum, Kuala Lumpur Selangor.*
1904 Robinson, Lady, *Worksop Manor, Notts.*
1869 † Robinson-Douglas, William Douglas, M.A., F.L.S., F.R.G.S., *Orchardton, Castle Douglas.*
1908 Rogers, The Rev. K. St. Aubyn, M.A., Church Missionary Society *Mombasa, British East Africa.*
1886 Rose, Arthur J., 1, *Harewood-road, S. Croydon.*
1912 Rosen, Kurt, Baron, *Zoologische Staatssammlung, Munich.*
1907 Rosenberg, W. F. H., 57, *Haverstock-hill,* N.W.
1868 Rothney, George Alexander James, *Pembury, Tudor-road, Upper Norwood,* S.E.
1894 † Rothschild, The Honble. Nathaniel Charles, M.A., F.L.S., F.Z.S., President, (V.-Pres., 1914; Council, 1904, 1913–), *Arundel-house, Kensington Palace Gardens,* W.
1888 † Rothschild, The Right Honble. Lord, D.Sc., F.R.S., F.L.S., F.Z.S., (Council, 1900), *Zoological Museum, Tring.*
1890 Routledge, G. B., *Turn Lodge, Heads Nook, Carlisle.*
1913 Rowden, Alfred Oliver, 3, *Archibald-road, Exeter.*
1887 Rowland-Brown, Henry, M.A., (V.-Pres., 1908, 1910; Sec., 1900–10; Council, 1914–), *Orkey-grove, Harrow Weald.*
1910 Rudge, Charles Henry.
1898 Russell, A., *Wilverley, Dale-road, Purley.*
1892 Russell, S. G. C., 19, *Lombard-street,* E.C.

1905 St. Quintin, W. H., *Scampton Hall, Rillington, York.*
1906 Sampson, Colonel F. Winn, 74, *Vineyard Hill-road, Wimbledon Park.*
1910 Saunders, H. A., *Brookfield-house, Swanage.*
1901 Schaus, W., F.Z.S., *U.S. National Museum, Washington, D.C., U.S.A.*
1907 Schmassmann, W., *Beulah Lodge, London-road, Enfield,* N.
1912 Schunck, Charles A., *Ewelme, Wallingford.*
1881 Scollick, A. J., 8, *Elmswood, Malden-road, New Malden.*
1911 Scorer, Alfred George, *Hill Crest, Chilworth, Guildford.*
1909 Scott Hugh, M.A., F.L.S., Curator in Entomology, *University Museum of Zoology, Cambridge.*
1911 Scott, Percy William Affleck, Chinese Imperial Customs Service, *Hangchow, China.*
1912 Seitz, Dr. Adalbert, 59, *Bismarckstrasse, Darmstadt, Germany.*
1911 Selous, Cuthbert F., M.D., M.R.C.S., L.R.C.P., *Agra, Barton-on-Sea, New Milton, Hants.*
1911 † Sennett, Noel Stanton, 32, *Bolton-gardens, S. Kensington,* S.W.
1862 Sharp, David, M.A., M.B., F.R.S., F.L.S., F.Z.S., (Pres., 1887–8; V.-Pres., 1889, 1891–2, 1896, 1902–3; Sec., 1867; Council, 1893–5, 1902–4), *Lawnside, Brockenhurst, Hants.*

1902 Sharp, W. E., (Council, 1912–13), *Charterlea, Wokingham-road, Crowthorne, Berks.*
1915 Shaw, Dr. A. Eland, c/o R. Kelly Esq., Solicitor, 59, *Swanston-street, Melbourne, Victoria, Australia.*
1886 Shaw, George T. (Librarian of the Liverpool Free Public Library), *William Brown-street, Liverpool.*
1905 Sheldon, W. George, *Youlgreave, South Croydon.*
1900 † Shepheard-Walwyn, H. W., M.A., *Dalwhinnie, Kenley, Surrey.*
1887 † Sich, Alfred, (Council, 1910–12), *Corney House, Chiswick*, W.
1911 Simes, James A., *Mon Repos, Monkham's-lane, Woodford-green, Essex.*
1904 Simmonds, Hubert W., 12, *Gray's Chambers, Court House-lane, Auckland, New Zealand.*
1913 Sitwell, Capt. F., *Wooler, Northumberland.*
1902 Sladen, Frederick William Lambart, *Dept. of Agriculture, Central Experimental Farm, Ottawa, Canada.*
1902 Sloper, Gerard Orby, F.Z.S., J.P., *Badminton Club, Piccadilly*, W.
1907 Sly, Harold Baker, *Mapledean, Ringley-avenue, Horley.*
1906 Smallman, Raleigh S., *Eliot Lodge, Albemarle-road, Beckenham, Kent.*
1915 Smith, Adam Charles, *Horton, Mornington road, Woodford Green.*
1901 Smith, Arthur, *County Museum, Lincoln.*
1911 Smith, B. H., B.A., *Edgehill, Warlingham, Surrey.*
1912 Smith, Roland T., 131, *Queen's-road, Wimbledon*, S.W.
1898 Sopp, Erasmus John Burgess, F.R.Met.S., 34, *Ferndale-road, Hove.*
1885 South, Richard, (Council, 1890–1), 4, *Mapesbury-court, Shoot-up Hill, Brondesbury*, N.
1908 Speyer, Edward R., *Ridgehurst, Shenley, Herts.*
1889 Standen, Richard S., F.L.S., (Council, 1906), *Newlyn, Romsey, Hants.*
1910 Stanley, The Rev. Hubert George, *Marshfield Vicarage, Cardiff.*
1898 Stares, C. L. B., M.R.C.S., L.R.C.P., *The Limes, Swanley Junction, Kent.*
1898 Stebbing, Henry, *Chaserood, Round Oak-road, Weybridge.*
1910 Stenton, Rupert, *St. Edward's, St. Mary Church, Torquay.*
1910 Stoneham, Hugh Frederick, Lieut. 1st Batt. E. Surrey Regt., *Stoneleigh, Reigate.*
1913 Storey, Gilbert, *Dept. of Agriculture, Cairo, Egypt.*
1915 Stott, Charles Ernest, *Woodcroft, Eglington-road, Chingford, Essex.*
1896 Strickland, T. A. Gerald, *Southcott, Poulton, Fairford.*
1900 Studd, E. A. C., *P.O. Box* 906, *Vancouver, British Columbia.*
1895 Studd, E. F., M.A., B.C.L., *Oxton, Exeter.*
1908 Swierstra, Corn. J., 1st Assistant, *Transvaal Museum, Pretoria.*
1884 Swinhoe, Colonel Charles, M.A., F.L.S., F.Z.S., (V.-Pres., 1894; Council, 1891–3; 1902–4), 6, *Gunterstone-road, Kensington*, W.
1894 Swinhoe, Ernest, 6, *Gunterstone-road, Kensington*, W.
1876 Swinton, A. H., *Oak Villa, Bruishfield, Romsey, Hants.*
1911 Swynnerton, C. F. M., *Gungunyana, Melsetter, S.-E. Rhodesia.*

1910 Tait, Robt., junr., *Roseneath, Harborough-road, Ashton-on-Mersey.*
1908 Talbot, G., *Witley Village, Surrey.*
1911 Tautz, P. H., *Cranleigh, Pinner, Middlesex.*
1893 Taylor, Charles B., *Gap, Lancaster County, Penn., U.S.A.*
1911 Taylor, Frank H., Australian Institute of Tropical Medicine, *Townsville, Queensland.*
1903 Taylor, Thomas Harold, M.A., *Yorkshire College, Leeds.*
1914 Temperley, Reginald, *Trevena, Harlow Oval, Harrogate,* and *L'Aurore, Vevey-la-Tour, Vaud, Switzerland.*
1909 Tetley, Alfred, M.A., 22, *Avenue-road, Scarborough.*
1910 Theobald, Prof. F. V., M.A., *Wye Court, Wye.*
1901 Thompson, Matthew Lawson, 40, *Gosford-street, Middlesbrough.*
1892 Thornley, The Rev. A., M.A., F.L.S., "*Hughenden,*" *Coppice-road, Nottingham.*
1907 Tillyard, R. J., M.A., B.Sc., F.L.S., Linnean Macleay Fellow in Zoology, *Kuranda, Mount Errington, Hornsby, New South Wales.*
1911 Todd, R. G., *The Limes, Hadley Green,* N.
1897 Tomlin, J. R. le B., M.A., (Council 1911–3), *Lakefoot, Hamilton-road, Reading.*
1907 Tonge, Alfred Ernest, (Council, 1915-), *Aincroft, Reigate, Surrey.*
1914 de la Torre Bueno, J. R., *Dasenbury Place, White Plains, New York, U.S.A.*
1907 Tragardh, Dr. Ivar, *The University, Upsala, Sweden.*
1859 † Trimen, Roland, M.A., F.R.S., F.L.S., (Pres., 1897–8; V.-Pres., 1896, 1899; Council, 1868, 1881, 1890), 33, *Croftdown-road, Highgate-road,* N.W.
1906 Tulloch, Col. B., *The King's Own Yorkshire Light Infantry,* c/o Messrs. Cox & Co., 16, *Charing Cross,* S.W.
1895 Tunaley, Henry, *Castleton, Searle-road, Farnham.*
1910 Turati, Conte Emilio, 4, *Piazza S. Alessandro, Milan, Italy.*
1898 Turner, A. J., M.D., *Wickham Terrace, Brisbane, Australia.*
1893 Turner, Henry Jerome, (Council, 1910-12), 98, *Drakefell-road, St. Catherine's Park, Hatcham,* S.E.
1906 Turner, Rowland E., (Council, 1909–10).
1915 Tytler, H. C., *Vacoas, Mauritius.*

1893 Urich, Frederick William, C.M.Z.S., *Port of Spain, Trinidad, British West Indies.*

1904 † Vaughan, W., *The Old Rectory, Beckington, Bath.*
1914 Veitch, Robert, Entomologist, c/o Colonial Sugar Refining Co., *Rarawai Mill, Fiji Islands.*
1909 Vidler, Leopold A., *The Carmelite Stone House, Rye, Sussex.*
1911 Vitalis de Salvaza, R., *Vientiane, Laos, Indo-China.*

1895 Wacher, Sidney, F.R.C.S., *Dane John, Canterbury.*

1897 Wainwright, Colbran J., (Council, 1901, 1912–14), 45, *Handsworth Wood-road, Handsworth, Birmingham.*

1878 Walker, James J., M.A., R.N., F.L.S., Secretary, 1905– (Council, 1894; Sec. 1899), *Aorangi, Lonsdale-road, Summertown, Oxford.*

1912 Wallace, Henry S., 6, *Kayle-road Villas, Sunderland.*

1914 Walsh, Mrs. Maria Ernestina, *Soekaboemi, Java, Dutch East Indies.*

1866 † Walsingham, The Right Honble. Lord, (Pres., 1889–90; V.-Pres., 1882, 1888, 1891–2, 1894–5; Council, 1896), *British Museum (Natural History), Cromwell-road,* S.W.

1910 Ward, John J., *Rusmurbe House, Somerset-road, Coventry.*

1908 Warren, Brisbane C. S., *le Chatagny, Territet, Switzerland.*

1869 Waterhouse, Charles O., I.S.O., (Pres., 1907–8; V.-Pres., 1900, 1909; Council, 1873, 1882–3; 1898–1900), *Ingleside, Avenue-gardens, Acton,* W.

1901 † Waterhouse, Gustavus A., B.Sc., F.C.S., *Allonrie, Stanhope-road, Killara, New South Wales, Australia.*

1914 Waterston, Rev. James, B.D., B.Sc., 22, *Blandford-road, Bedford Park,* W.

1914 Watt, Morris N., *St. John's Hill, Wanganui, New Zealand.*

1893 Webb, John Cooper, 218, *Upland-road, Dulwich,* S.E.

1876 † Western, E. Young, 27, *Pembridge-square, Notting Hill Gate,* W.

1906 Wheeler, The Rev. George, M.A., F.Z.S., (Secretary, 1911– ; V.-Pres., 1914), 37, *Gloucester-place,* W.

1910 White, Edward Barton, M.R.C.S., *Cardiff City Mental Hospital, Cardiff.*

1911 Whitehouse, H. Beckwith, M.S., F.R.C.S., 52, *Newhall-street, Birmingham.*

1913 † Whitley, Percival N., *Brantwood, Halifax;* and *New College, Oxford.*

1913 † Whittaker, Oscar, *Ormidale, Ashlands, Ashton-upon-Mersey.*

1911 Whittingham, Rev. W. G., *Knighton Rectory, Leicester.*

1906 Wickwar, Oswin S., *Charlemont, Gregory-road, Colombo, Ceylon.*

1903 Wiggins, Clare A., M.R.C.S., *Entebbe, Uganda.*

1896 Wileman, A. E., *Thatched House Club, St. James'-street,* S.W.

1910 Willcocks, Frank C., Entomologist to the Khedivial Agricultural Society, *Cairo, Egypt.*

1911 Williams, C. B., *The John Innes Horticultural Institute, Mostyn-road, Merton, Surrey.*

1915 Williams, Harold Beck, 82, *Filey-avenue, Stoke Newington,* N.

1915 Winn, Albert F., 32, *Springfield-avenue, Westmount, Montreal, Canada.*

1894 Wolley-Dod, F. H., *Millarville P. O., Alberta, N.W.T., Canada.*

1881 Wood, The Rev. Theodore, *The Vicarage, Lyford-road, Wandsworth Common,* S.W.

1905 Woodbridge, Francis Charles, *South Mead, The Common, Gerrard's Cross S.O., Bucks.*

1914 Woodforde, Francis Cardew, B.A., 19, *Friar's Entry, Oxford.*

1912 Woodruffe-Peacock, Rev. E. Adrian, F.L.S., F.G.S., *Cadney Vicarage, Brigg, Lincolnshire.*

1888 Yerbury, Colonel John W., late R.A., F.Z.S., (Council, 1896, 1903-5), 2, *Ryder-street, St. James's*, S.W.

1892 Youdale, William Henry, F.R.M.S., 21, *Belle Isle-street, Workington.*

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[Phil. Trans. Roy. Soc. Lond., Series B, Vol. 205, 1914.]
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——— On a collection of Javanese Crane-flies (Tipulidae, Diptera) in the United States National Museum.
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Further notes on the mechanism of the Transmission of Plague by fleas. Notes on the development of *Bacillus pestis* in bugs (*Cimex lectularius*) and their power to convey infection.
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——— The *Parandra* borer as an orchard enemy.
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[Proc. Roy. Soc., Biol. Sciences, Ser. B, Vol. 88, Nos. B 600, 602, Aug. and Sept. 1914.] *By Exchange.*

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[Annals Applied Biol., Vol. I, 1914.]
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——— Potato spraying and dusting in New Jersey, U.S.A. [A method for controlling the potato flea-beetle, *Epitrix cucumeris*, Harr.]
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[Nov. Zool. XXII, Feb. 1915.] *The Author.*

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PART I. JUNE 26, 1915.

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OF

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FOR THE YEAR 1915.

I. *New Species and Subspecies of* Pierinae.

By F. A. DIXEY, M.A., M.D., F.R.S., Fellow of Wadham College, Oxford.

[Read May 6th, 1914.]

PLATES I, II.

THE following forms, some of which appear to be of specific and others of subspecific rank, have been presented at various times to the Hope Collection at Oxford. The types in every case are in the Hope Collection.

1. **Teracolus rogersi**, sp. n. (Plate I, figs. 1–4.)

♂. Exp. al. 35 mm. *Upperside* creamy white; fore-wings with a deep orange apical patch, separated from the rest of the wing by a nearly straight narrow dark band with blurred edges; this band leaves the costa at a point just opposite the outer termination of the cell, and reaches the hind margin at the termination of the first branch of the median vein. Costa and hind margin with a black border, broadened from the termination of the third subcostal to that of the first median vein, elsewhere narrow. The veins within the apical orange patch are black, and the dark broadened border is prolonged inwardly upon them for a short distance. There is a minute black spot at the apex of the re-entrant angle at the outer end of the cell, and a small black patch at the base of the wing,

somewhat prolonged along the inner margin. Fringe darkish opposite the apical patch; elsewhere pale. Hind-wings narrowly bordered with black, a blackish patch at the marginal termination of each branch of the median, of the radial, and of the two subcostal veins, the latter three patches being more or less fused together. A minute blackish streak, representing a submarginal spot, near the border; running between, and parallel with, the third median and radial veins. Base of the wing with a blackish patch, rather larger and more diffused than that of the fore-wing. Fringe pale.

Underside. Fore-wings white; the apical area, which corresponds in size with that on the upper surface, divided into an outer ochreous and inner pale orange band by a series of four minute dusky spots, elongated in a direction parallel with the veins. Discoidal spot somewhat larger and more distinct than on the upper surface. Hind-wings reddish ochreous with a slight dusky clouding in the precostal space, along the posterior half of the cell, and between the median and submedian veins. A bright orange-yellow streak along the costa, and a submarginal series of six diffused dusky spots, each occupying one of the interspaces from the costal to the second median; of these the first (in the costal interspace) is the largest, and the third (in the second subcostal interspace) is almost obsolete. A small squared black spot at the re-entrant angle terminating the cell, bounded internally by a slight diffusion of orange-yellow.

♀. Exp. al. 36–39 mm. *Upperside* pale creamy white; fore-wings with an orange apical patch of nearly the same shade and relative size as in the male. This patch is separated from the rest of the wing by an irregular dark bar, narrow in the middle of its course, but expanding anteriorly into a triangular blotch with its base resting on the costa, and posteriorly becoming fused with a curved submarginal band of dark spots, increasing in size from before backwards, and traversing the middle of the orange patch from the second subcostal to the second median interspace. The costa as far as the apical patch is narrowly bordered with grey, the patch itself is bounded anteriorly and posteriorly with black, the black posterior margin being much thicker than in the male, and less markedly prolonged along the veins, but being similarly narrowed as it leaves the patch and approaches the anal angle. As in the male, the veins crossing the apical patch are black. The black discoidal spots are larger and more conspicuous than in the male; the base of the wings shows a greyish diffusion, and a well-marked dark grey bar runs in the median and submedian interspaces, parallel with the inner border, and ending near the anal angle in a fairly definite dark patch which appears to be in series with the submarginal spots. The fringes are pale reddish, taking a darker

tinge in the region of the apical patch. Hind-wings narrowly bordered with black, a marginal row of dark spots as in the male, the anterior three being fused into a marginal band; a submarginal series of dark spots occupying the interspaces, that in the radial interspace (between the radial and third median veins) being the largest and darkest. The base shows a greyish clouding, which is slightly prolonged towards the anal angle. A minute black discoidal spot present. Fringes pale reddish.

Underside. Fore-wings white; inner four-fifths of cell washed with pale lemon-yellow. Apical patch divided by a row of dark submarginal spots, corresponding to those on the upper side but more discrete, into an outer reddish-ochreous and inner orange-ochreous portion, the contrast between the two tints being much less marked than in the male. The black discoidal spot is not larger than on the upper surface. A pale greyish bar runs parallel with and close to the inner border, ending near the anal angle in a fairly definite dark patch. Hind-wings as in the male, but slightly darker and with a somewhat more pronounced dusky suffusion. The submarginal spots are much larger than in the male. The discoidal dot is very slightly touched with orange. There is an orange streak along the costa, and a pale Indian-red patch at the origin of the median vein.

In both sexes the row of submarginal spots in the median and submedian interspaces of the hind-wing (in the male visible only on the under surface) conforms more nearly to the curved margin of the wing than is usual in this group of *Teracolus*.

1 ♂, 3 ♀♀ (Taveta), in Hope Collection, Oxford. The male and one of the females were bred by the Rev. K. St. A. Rogers, emerging on August 6, 1905. A second female was captured on August 7, 1905, and a third female on July 16, 1910, both by Mr. Rogers.

The species may be an East African representative of *T. halyattes*, Butl., the type of which came from Natal. *T. halyattes* is regarded by Butler as the dry-season phase of his *Teracolus lais*, the type of which also came from South Africa. The representative of *T. lais* in the Nile district is doubtless *T. ephyia*, Klug, and the present form, intermediate between *T. lais* and *T. ephyia* in geographical position, is in some respects intermediate also in character. One feature that serves to distinguish it from the type of *T. halyattes* is that the submarginal series of spots on the hind-wing tends to form a curve more or less conformable to that of the wing-margin, whereas in *T. halyattes*, as gener-

ally in members of the *achine* group of *Teracolus*, the submarginal series of the hind-wing is sharply bent to a right angle at the level of the third median branch. In those specimens that I have examined, the males of *T. lais* and *T. rogersi* can be distinguished by their plume-scales. These are nearly of the same size in the two forms, but in *T. lais* the sides of the lamina proximally to the apex are almost parallel, whereas in *T. rogersi* they tend to converge towards the spring of the fimbriae. The plume-scales of *T. ephyia* have their sides usually parallel, as in *T. lais*, but they are smaller, and generally much narrower in proportion to their length.

Fig. 1.
T. lais, Butl. × 310.

Fig. 2.
T. rogersi, n.sp. × 310.

Fig. 3.
T. ephyia, Klug. × 310.

Scent-scales.

2. **Belenois victoria**, sp. n. (Plate II, figs. 5–8.)

♂. Exp. al. 55 mm. *Upperside* white; a slight greyish dusting close to the body. Costa of the fore-wing very narrowly edged with black. A black apical patch, continued as an irregular black border along the hind margin. The irregularity of the border is chiefly due to a marked projection inwards between the second and third median branches, the border at this point filling about the outer two-fifths of the interspace indicated. The marginal ends of the first median branch and of the submedian vein are marked by black spots, prolonged for a short distance inwards. The former of these spots is large, and fuses with the black border. The latter spot is smaller and may remain distinct, or may be connected with the dark border by an intermediate dusting of grey. At the outer end of the cell is a large roundish black spot, covering the second discocellular vein. This spot may be entirely isolated, or may be connected with the dark edging of the costa by a dusky curved band, more or

less developed, following the outer and anterior margin of the cell, and so having its concavity directed towards the root of the wing. Some or all of the interspaces between the veins which traverse the dark apex and hind border are marked by a powdering of white scales, generally very indistinct, but in the space between the fourth subcostal branch and the first radial vein assuming the appearance of a definite white spot. The hind-wing may be entirely immaculate, or may have the marginal ends of the veins marked with black points.

Underside. Fore-wing white; the costa slightly edged with greyish yellow. Apical patch, corresponding in extent with that of the upper surface, of the same greyish yellow, bordered inwardly with a slightly festooned streak of pale fawn-colour. A dark spot more or less developed, in the second median interspace, corresponds in position with the inward projection of the dark hind border above. The spot on the second discocellular vein corresponds with that on the upper surface, but is of a less intense black; there may or may not be a trace of the curved dusky band connecting it with the costa. In some specimens there is a slight yellow shade at the root of the wing.

The hind-wing is of a greyish yellow like the apex of the fore-wing. There is a streak of vivid orange along the whole length of the costa, broadest near the body, and reaching as far as the marginal end of the first subcostal branch; a short streak of the same colour occupies the root of the interspace between the median and submedian veins. The remaining marks are of the same pale fawn-colour as that bordering the apical patch of the fore-wing. They consist of a slight accentuation of the veins with their branches, broadening into a patch on the second discocellular, and including the vestigial vein between the median and submedian and that within the cell; including also a patch between the origins of the first and second median branches and another patch adjoining it internally; a series of submarginal spots in the interspaces, those from the second subcostal to the submedian vein taking an arrow-head form with the points directed inwards; and, finally, a series of linear spots at the marginal ends of the veins and their branches, parallel with the margin, and occasionally fused into a narrow marginal band.

♀. Exp. al. 53 mm. *Upperside.* Fore-wing white; hind-wing varies from white through primrose yellow to deep yellow ochre. Dark markings as in the male, but more pronounced. Fore-wing, costal edging broader, apical black continued along hind margin as far as anal angle; no separate marginal spots; no white dusting in interspaces; the black spot on the second discocellular joined to

the costa by a broad dusky band which may occupy the anterior half of the cell. Marginal spots of the hind-wing much larger than in the male.

Underside as in the male, but with a conspicuous orange flush at the base of the fore-wing, extending over the proximal two-thirds of the cell, and showing faintly through on the upper surface.

29 ♂♂, 4 ♀♀ (Tiriki, Victoria Nyanza; and Toro, W. Uganda), in the Hope Collection, Oxford.

Fourteen of the males and all four females were captured by Mr. C. A. Wiggins in the Tiriki Hills, N.E. of the Victoria Lake, during February and March 1903. Fifteen males (also presented by Mr. Wiggins) were taken by native collectors in the Toro country, on the eastern slopes of Ruwenzori, in November and December 1900. These are all recorded by Mr. S. A. Neave, under the head of *Belenois zochalia* f. *formosa*, Butl., in Novitat. Zoolog. vol. xi, 1904, p. 358.

This is a very distinct form of the *Belenois zochalia* group. It is easily distinguished from *crawshayi*, Butl., *tanganyikae*, Lanz (*formosa*, Butl.), and *diminuta*, Butl., by the darker apex and border of the fore-wing, from which the white spots have almost disappeared in the male and have entirely vanished in the female; the nearly immaculate white or yellow of the hind-wing; but especially by two features of the under surface, viz. the great prolongation of the orange costal streak, and the general character of the dark markings on the hind-wing. In the other forms of the *B. zochalia* group, these latter markings are linear, looking as if they had been drawn with a pencil or stiff brush. When they become faint or disappear, as in *B. diminuta*, they do so by attenuation and curtailment. In *B. victoria* they look as if they were made with a soft brush, and they become faint by gradually melting, without diminution of size, into the ground-colour of the wing.

In the National Collection there are three males of this form, two from Mount Elgon and one from Toro. They are ranked as *B. formosa*, but differ in the points stated from the type of *formosa* beside them.

Among the African forms of the genus *Nychitona*, Butl., (*Leptosia*, Auriv.), there is a race or subspecies first known to me by four specimens from the region of the Victoria Nyanza, presented to the Hope Collection by Mr. C. A. Wiggins. The series consists of two males from the Toro country on the eastern slopes of Ruwenzori, captured by natives in November or December 1900; and two females, one captured by Mr. Wiggins at Entebbe on the N.W. shore of the lake on April 8, 1903, and the other caught by a native in the Ugaia country, south of the Kavirondo gulf, in January 1903. These specimens differ in some respects from all forms of *Nychitona* hitherto described, but may be considered as a subspecies of *N. medusa*, Cram.

3. **Nychitona wigginsi,** subsp. n. (Plate III, figs. 9–12.)

♂. Exp. al. 46 mm. *Upperside* dead, opaque white, with a very faint greenish-yellow tinge; not semi-translucent as in some other forms of *Nychitona*. Fore-wings with slight fuscous mottling along the costa, reaching from the body to a point opposite the origin of the first branch of the subcostal. A dark fuscous apical crescentic patch, slightly waved on its inner aspect but not indented as in most other forms of *Nychitona*, beginning at a point on the costa nearly opposite the origin of the second subcostal branch, and ending on the hind margin in the interspace between the first and second median branches. Hind-wings bordered with a very narrow dark line, the centre of each interspace marked on the border by a minute dark spot. There is no other marking on the upper surface of either fore or hind-wing, but the mottling of the under surface shows faintly through.

Underside white; a dull green mottling filling the basal half of the cell, and prolonged on the costa as far as the termination of the first subcostal branch. A similar mottling on the apical area corresponds to the dark crescentic patch on the upper surface, and is also found over the whole of the hind-wing. This mottling of the hind-wing is scattered generally over the surface of the wing, and shows little or no tendency to fall into the parallel streaks which are conspicuous in some other forms of *Nychitona*.

♀. Closely resembles the male in size and aspect. In both sexes the tint and texture of the upper surface give an aspect which is conspicuously different from that of other forms of *Nychitona*.

The marked resemblance of this form to the curious *Leuceronia pharis*, Boisd., which also occurs in the Ugaia

country, and probably in the Toro district, was commented on by me in Trans. Ent. Soc. Lond., 1908, p. 569. I may here be allowed to mention that the statements there made had reference to the present form of *Nychitona* only, and not, as has been supposed, to other forms, such as that named *immaculata* by Aurivillius, more or less closely resembling it.

4. **Hesperocharis longstaffi**, subsp. n. (Plate II, figs. 1–4.)

♂. Exp. al. 52 mm. *Upperside.* Fore-wings very pale chrome yellow, passing gradually into pale ochreous at the apex. Fuscous scales form a very narrow edging to the costa, and are collected about the marginal terminations of the subcostal and median branches, and of both radial veins, appearing in this situation as a series of small ill-defined triangular spots, fused at the apex of the wing by their bases, and diminishing in size along the posterior border; a fuscous line, belonging partly to the fringe, extends from the apex to the termination of the first median branch. Hind-wing, pale ochreous like the apex of the fore-wing, becoming lighter towards the costa and deepening slightly towards the hind and inner margin. Anal angle somewhat prolonged.

Underside. Fore-wings dead white; apex pronounced yellow ochre. A very slight fuscous edging to the outer two-thirds of the costa, prolonged for a short distance round the apex. A small, ill-defined fuscous spot on the costa, just proximal to the origin of the second branch of the subcostal. Hind-wings, rich yellow ochre, deepening on the costa, which is narrowly edged with fuscous throughout its whole extent except a very small portion near the body. A series of four fuscous spots runs almost parallel with the costal and hind margin, the first two actually on the costa, the third barely touching it, and the fourth a little distance inwards from the hind border. These spots, which have a purplish tinge from contrast with the general yellow of the wing, are situated respectively on each side of the costal vein, in the interspace between the two branches of the subcostal, and in that between the lower subcostal and radial. The first two are the most intense in colour, the fourth distinctly fainter, the second and third are the largest. There is a

fifth spot, similar to the fourth of the preceding series, but smaller, just internal to the origin of the first median branch. The ventral part of the thorax shares in the rich ochreous colour of the hind-wings.

♀. Exp. al. 60 mm. (Another ♀ in Coll. Hope, 57 mm.) *Upperside* of both wings a bright canary yellow, somewhat deeper on the hind-wing and at the apex of the fore-wing. A narrow fuscous edging and apical spots as in the male. *Underside* as in the male except that the dead white of the fore-wing is replaced by canary yellow, and that the fuscous spots on the fore-wing and between the second subcostal and radial of the hind-wing may be absent.

In the male the fore-wing has a sharp apical angle, and the posterior margin is slightly concave. In the female the apex is more rounded, and the posterior margin is nearly straight. The hind-wing in the female has the anal angle slightly prolonged, but less so than in the male.

1 ♂, 2 ♀♀ (Venezuela), in Hope Collection, Oxford.

All three specimens were captured by Dr. G. B. Longstaff; the male and one female on January 9, 1913, at an altitude of about 1300 ft., below Zigzag Station, La Guaira, Venezuela; the second female on January 11, 1913, at about 1000 ft., between Curatici and Zigzag.

The present is the Venezuelan form of the group containing *H. jaliscana*, Schaus (Mexico), *H. lenoris*, Reak. (Mexico), *H. idiotica*, Butl., and *H. crocea*, Bates (Costa Rica). The earliest-named of the group appears to be *H. crocea*, which is probably indistinguishable from *H. lenoris*, as remarked by Godman and Salvin (Biol. Centr.-Amer., Rhopalocera, vol. ii, pp. 127–8). *H. idiotica* may be the same; the locality of the type is unknown.

H. longstaffi is distinguished from *H. crocea* by the absence of orange suffusion on the upper surface of the hind-wing; Dr. Longstaff's specimens differ from co-types of *H. jaliscana* by the deeper colour in both sexes, by the fainter development of the fuscous markings at the apex of the fore-wing, and by the much greater prominence of the dark costal spots on the under surface of the hind-wing.

A male Pieris was captured by Dr. G. B. Longstaff, at an elevation of about 1300 ft., between Zigzag Station and the port of La Guaira, Venezuela, on March 29, 1907. This capture is recorded in his book, "Butterfly Hunting in Many Lands," 1912, p. 320, and the specimen is well figured on Plate III, figs. 1, 2 of the same volume. At the same place, on January 11, 1913, Dr. Longstaff caught, together with specimens which appear to be referable to *P. sevata*, Feld., a female Pierine which I believe to be conspecific with the male above mentioned. These two specimens were referred to by me in Proc. Ent. Soc. Lond., 1913, pp. cxiii, cxiv, and are here described under the name of *Pieris janeta*.

5. **Pieris janeta**, sp. n. (Plate II, figs. 5, 6.)

♂. Exp. al. 62 mm. *Upperside* white with a slight but distinct greenish tinge. A slight fuscous edging to the costal and posterior margin, expanding somewhat at the apex, and prolonged nearly to the anal angle. A somewhat paler fuscous streak fills the space between the costa and costal vein for about two-thirds of the distance from base to apex. Fore-wing otherwise immaculate. Conspicuous streaks of roughened texture, dead white in colour, accompanying both sides of the submedian vein, of the median trunk from the origin of its first branch to that of its third, and of the median branches themselves. They are also found on both sides of the lower, and on the inner, or posterior, side of the upper radial and of that part of the subcostal trunk from which the upper radial originates, on the outer side of the two discocellular veins, and finally as a small patch in the upper and distal angle of the cell. The streaks generally fuse together at the root of each interspace, but in the interspace between median and submedian they remain distinct, neither streak reaching inwards as far as the median trunk. Hind-wing immaculate; roughened streaks like those on the fore-wing accompanying the subcostal and median veins. Third branch of subcostal in fore-wing very short.

Underside: fore-wings generally dull white; dead white where the roughened streaks show through from the upper surface. Apex and costa pale ochreous. Hind-wings uniformly ochreous, of a somewhat deeper shade than the apex of the fore-wing; a fuscous spot, like that in the female, occupying the angle between the lower discocellular and third branch of the median vein. The costa thinly edged with bright yellow; a minute spot of the same at the root of the subcostal vein.

♀. Exp. al. 60 mm. *Upperside* dull creamy white; not tinged with greenish, as in the male. Fore-wing with a fuscous shade along the costa, filling the space between the costa and the subcostal vein at the base, and for rather more than half the length of the cell. This shade is continued distally as a narrowing line along the costa as far as the apex, where it fuses with a fuscous apical patch, small in extent and prolonged as a narrow tapering band along the posterior margin as far as the first branch of the median vein. A few fuscous scales on the lower discocellular vein. Hind-wing

FIG. 4.
P. janeta, n. sp. × 120.

FIG. 5.
P. sevata, Feld. × 120.

SCENT-SCALES.

immaculate. Anal angle slightly prolonged. The third branch of the subcostal in the fore-wing appears to be absent.

Underside: fore-wing dull white, apex and costa pale greyish ochreous. Hind-wing pale ochreous with a slight pinkish shade; a fuscous spot 1–2 mm. in diameter, close to the lower discocellular vein, in the interspace between the third median branch and the radial. The costa edged with deep yellow; a minute spot of the same at the root of the subcostal vein.

The male of *P. janeta* is easily distinguishable from the male of *P. sevata* by the character and distribution of the scent-scales. These in *P. janeta* are on an average more than half as long again as in *P. sevata*. Moreover, in *P. sevata* the mealy streaks formed by these scales fuse along the

inner or posterior side of the median vein proximally to the origin of the first median branch; in *P. janeta* the area indicated is free from scent-scales (*see* Proc. Ent. Soc. Lond., *loc. cit.*, where "submedian" should be read for "internal").

P. janeta may perhaps be a subspecies of *P. sincera*, described by Weymer (Reiss und Stübel, Reisen in Sud.-Amerika, 1890, p. 123; Taf. III, fig. 19), from a male specimen captured on the sea-level at Guayaquil, Ecuador. But it differs in several particulars from Weymer's figure and description.

6. **Pieris howarthi**, sp. n. (Plate II, figs. 7–10.)

♂. Exp. al. 58 mm. *Upperside* dull white very slightly tinged with green. Fore-wing with pale fuscous spots on the apex and along the hind-margin, at the extremities of the branches of the subcostal (except the first), of the two radials and of the branches of the median; the first and last of these spots being represented only by a few fuscous scales. A conspicuous dark fuscous spot on the lower discocellular. Conspicuous streaks of roughened texture, dead white in colour, accompanying both sides of the first and second median branches and of the submedian vein; also the inner side of the third median and of the median trunk from the origin of the first branch to that of the third. Beneath, the fore-wing is dull white, the apical region pale fuscous. The discocellular spot is larger than on the upper surface, and of a less deep fuscous shade. The roughened areas of the upper surface show through as dead white streaks. There are traces of a pale fuscous discal spot on each side of the third median, and above the second median, in each case about half-way between the cell and the margin of the wing.

The hind-wing is immaculate above, and shows no roughened streaks. Beneath, it is of a pale yellow ochre, plentifully besprinkled with pale fuscous scales like those of the fore-wing. These are more closely set in some places than in others, forming a brownish shade over the base of the wing; this shade occupies most of the space between the costal and first subcostal branches, a quarter or more of the subcostal interspace, and nearly the whole of the cell, stopping just short of the lower discocellular. Outside the cell it accom-

panies the inner side of the median trunk and first median branch, but leaves free the greater part of the course of the submedian vein. In the angle between the median trunk and the first median branch, it passes into a curved band which takes its course round the end of the cell, turns forward, and becomes lost on the lower aspect of the second subcostal. The fuscous shade is somewhat deeper just anteriorly to the third median branch than elsewhere, but it does not form a definite spot. A much paler fuscous infusion forms a broad marginal shading to the wing. There is a minute dark fuscous spot on the lower discocellular, close to the origin of the radial; the costa is edged with rich orange, prolonged along the margin as a narrowing streak as far as the end of the first subcostal. A spot of the same colour occupies the root of the subcostal at its junction with the body.

♀. Exp. al. 52 mm. (Another ♀ measures 54 mm.) *Upperside* white tinged with greenish yellow. Fore-wing with a slight duskiness along the costa, which opposite the end of the cell passes into a definite dark streak reaching to the apex. The extremities of the veins along the hind margin marked, as in the male, with fuscous spots; these diminish from before backwards; no spot on the submedian vein. A dark fuscous spot, larger than in the male, occupies nearly the whole of the lower discocellular vein; and dark discal spots, similar in character and situation to those on the lower surface in the male, but more pronounced, occur in connection with the second and third median branches. The series is continued by another smaller spot internal to the first median branch. Hind-wing immaculate except for a minute dark spot on the lower discocellular vein.

Beneath, the fore-wings are white, tinged with the same greenish yellow as on the upper surface; but even paler, especially towards the inner margin. The apical area is ochre yellow dusted with yellowish brown. The same brownish dusting is continued inwardly as an ill-defined streak along the costa, but dies out before reaching the body. Within the apical area it collects chiefly at the marginal ends of the veins, forming indistinct spots which are prolonged as a diminishing series as far as the termination of the first median. A further condensation of brownish or fuscous scales forms a patch at the inner end of the apical area where this meets the costa. This patch is in series with dark discal spots occupying corresponding situations with those on the upper surface; the last of them is marked only by a few brown scales. A dark oval spot, larger than the corresponding spot on the upper surface, occupies the lower discocellular vein. The ground-colour of the hind-wings is the same as that of the apical area of the fore-wings, viz.

yellow ochre. Like the latter area it is plentifully dusted over with yellowish brown scales. These form a deep shade over the basal half of the wing, terminating distally by a curved edge running nearly parallel with the wing-margin, and leaving a small area of the yellow ground-colour at and beyond the end of the cell. Broad rays of a paler shade of yellowish brown accompany the distal portions of the veins as they traverse the yellow marginal area. The veins themselves, with their branches, share in the ochre yellow of the ground-colour. There is a conspicuous dark brown spot, larger

Fig. 6.
P. howarthi, n. sp. × 120.

Fig. 7.
P. josepha, Godm. & Salv. × 120.

Scent-scales.

than that of the upper surface, on the lower discocellular vein, close to the origin of the radial. The costa is edged with rich orange, and the same colour is prolonged round the base of the wing as far as the origin of the subcostal vein.

The third subcostal branch of the fore-wing is present in a rudimentary form on the right side of the male type and both sides of the female type. It appears to be absent from the left side of the male type, and from both sides of another female in the Hope Collection.

1 ♂, 2 ♀♀ in Hope Collection, Oxford. These were captured on the sea-level, at Tembabichi Bay, Lower

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NEW FORMS OF PIERINAE.

Explanation of Plate I.

Fig. 1.	*Teracolus rogersi*,	n. sp.,	♂,		Taveta.
2.	,,	,,	,,	underside,	,,
3.	,,	,,	♀,		,,
4.	,,	,,	,,	underside,	,,
5.	*Belenois victoria*,	,,	♂,		Tiriki.
6.	,,	,,	,,	underside,	,,
7.	,,	,,	♀,		,,
8.	,,	,,	,,	underside,	,,
9.	*Nychitona wigginsi*,	n. subsp.,	♂,		Toro.
10.	,,	,,	,,	underside,	,,
11.	,,	,,	♀,		Entebbe.
12.	,,	,,	,,	underside,	,,

Note.—Fig. 2. The type has two minute subapical spots not shown in the figure; in the hind-wing the relative size of the first and second submarginal spots should be reversed, and the spot nearest the anal angle should be omitted.

Figs. 2 and 4. The discocellular spot in the hind-wing of each type is touched proximally with orange.

Fig. 6. The costal orange streak in the type is not prolonged beyond the termination of the first subcostal branch.

Fig. 8. The marginal spots of the hind-wing are in the type of the same colour as the remaining spots of the hind-wing.

Explanation of Plate II.

Fig. 1.	*Hesperocharis longstaffi*,	n. subsp.,	♂,		Venezuela.
2.	,,	,,	,,	,, underside,	,,
3.	,,	,,	,,	♀,	,,
4.	,,	,,	,,	,, underside,	,,
5.	*Pieris janeta*,	n. sp.,	♂,		,,
6.	,,	,,		♀,	,,
7.	*Pieris howarthi*,	,,	♂,		Lower California.
8.	,,	,,	,,	underside,	,,
9.	,,	,,	♀,		,,
10.	,,	,,	,,	underside,	,,

Note.—Fig. 2. A small fuscous spot on the costa of the fore-wing, present in the type, is not shown in the figure.

Fig. 5. A minute yellow spot at the root of the subcostal vein in the hind-wing underside is omitted from the figure.

H. Knight del. West, Newman chr

NEW FORMS OF PIERINAE

California, Lat. 26° 5 N., by Mr. Osbert H. Howarth, so long ago as March 21, 1898. They have hitherto remained undescribed, but were mentioned by me in Proc. Ent. Soc. Lond., 1913, p. cxiv.

P. howarthi belongs to the same section of *Pieris* as the preceding species. Its nearest relatives are *P. josepha*, Godm. & Salv., *P. josephina*, Godt., and *P. amaryllis*, Fabr. (Central America and West Indian Islands). It is quite distinct from all of these, being much smaller, and differing markedly on the underside. It resembles *P. josepha* and *P. josephina* in the character of its plume-scales, which are some of the longest known to me in the whole sub-family of Pierines.

Note.—Owing to a prolonged absence from England, the author was unable to superintend the printing of the Plates which have been prepared from Mr. H. Knight's admirable drawings. A few very slight inaccuracies have resulted, attention to which is called at the foot of the Explanation of each Plate.

Explanation of Plates I, II.

[*See Explanation facing the* Plates.]

II. *Revision of the Mexican and Central American* Telephorinae (*Fam.* Telephoridae), *with descriptions of new species.* By George Charles Champion, F.Z.S.

[Read November 18th, 1914.]

Plates III—IX.

This paper concludes the revision of the Mexican and Central American *Telephoridae.* The *Chauliognathinae* were dealt with in Part I of the Transactions of our Society for the present year. The abundant additional material received from Mexico since 1885 has of course greatly increased our knowledge of these insects, and the dissection of the males of *Discodon*, *Photinomorpha*, *Polemius*, etc., has revealed an extraordinary genital armature. These structures, however, are much more difficult to describe from dried specimens than those of the *Chauliognathinae*, the rigid median and lateral lobes in the latter being easily seen. In *Discodon* and its allies there are no corresponding lobes present, and the complex armature of spines and hooks is usually in part or wholly withdrawn into the internal sac, and is only visible when the insects have died with the armature evaginated. Fortunately, amongst the specimens dissected some have been found in this condition (Plate V, figs. 16, 22, 23*a*), so that we are able to give figures of several of them. In the males of all the Silini the polished glabrous ventral segment covered by the divided exposed terminal one (seventh) is assumed to be the eighth and the smaller following one the ninth. Both are really flattened tubes, usually with a longer ventral and a shorter dorsal surface, the latter often divided at the apex into two short, broad lobes or claspers. In a few cases a very long, slender, chitinous flagellum has been detected, this piece doubtless remaining in most cases in the body after the aedeagus has been extracted. It is impossible, therefore, to compare the various structures satisfactorily from the dried insects; but sufficient differences have been found to show the important characters (such as are well known to occur in

Malthodes) present in the ♂ armature. In *Podabrus* there is an additional exposed ventral segment, the ninth segment has symmetric lateral lobes, and the membranous internal sac, when seen evaginated (Plate IV, fig. 2), is apparently free from hooks or spines. In *Maronius* and *Belotus*, genera with greatly abbreviated elytra and tubuliform processes along the margins of the abdomen, the genital armature is highly developed and asymmetric, and very like that of the *Chauliognathinae*.

The Silini may be grouped by the form of the tarsal claws, and the position of the lateral incisions of the prothorax, in the males. The species mimicking Lampyrids and Lycids are, as usual, difficult to locate till their structural characters have been examined.

The consecutively numbered illustrations on Plates IV–VII, figs. 1–49, show the evaginated and non-evaginated condition of the ♂ genital armature—the tips only of two or four spines being visible in the distal opening of the internal sac in most specimens of the dried insects—the form of the seventh, eighth, or ninth ventral segment, etc. The descriptions of the armature are taken from dried examples, and are therefore incomplete. With one exception, the whole of the species of the subfamily *Telephorinae* recorded by Gorham from Central America in 1881–1885 were described as new. The 183 species now enumerated from the same region include 72 novelties and 11 forms added by Pic during recent years. Three new genera are also characterised.

Subfam. *TELEPHORINAE.*

Group Telephorini.

The group including *Telephorus*, *Rhagonycha* and allied forms is represented in Mexico by the genus *Podabrus*, which is characterised by the undivided, exposed terminal ventral segment of the male, the symmetric genital armature, and the toothed or cleft tarsal claws and simple prothorax in both sexes. *Discodon* is closely related to *Polemius* and *Silis*, and must be placed in the same group. *Plectonotum*, included in the Silini by Gorham, has the thickened lateral margin of the prothorax abbreviated before the base, but it agrees in other respects with the Telephorini, and seems best placed here. It is probable that nearly

all the Tropical American species described under *Telephorus* * are referable to *Chauliognathus*, *Discodon*, or *Polemius*.

Podabrus.

Podabrus, Westwood; Gorham, Biol. Centr.-Am.,Coleopt. iii, 2, p. 284 (1885).

Gorham described a single species of this holarctic genus from N. Mexico, his types of which are males. A second, from Durango, was subsequently received from Höge. Two Miocene forms from Florissant have recently been named by Wickham. In *Podabrus* eight ventral segments are exposed, the eighth being oval and uncleft in ♂. The evaginated membranous internal sac of the aedeagus is shown on Plate IV, fig. 2.

1. **Podabrus mexicanus.**

Podabrus mexicanus, Gorh., loc. cit.; Schaeff., Journ. N. York Ent. Soc. xvi, p. 62.

♂. Eighth ventral segment rather large, oval; ninth segment broadly semicircularly excavate, divided towards the apex into two rather broad, sinuous, concave subacuminate lobes, the corresponding dorsal segment also bilobate, the two lobes broadly rounded at the apex. (Fig. 1.)

Hab. North America, Huachuca Mts., Arizona; Mexico, Chihuahua.

2. **Podabrus caliginosus**, n. sp.

Elongate, narrow (♂), broader (♀), black, the base of the mandibles, the sides of the head in front, and the prothoracic margins obscure testaceous or rufo-testaceous. Head together with the prominent eyes broader than the prothorax in ♂, narrower than the much broader prothorax in ♀, coarsely, closely punctate; antennae nearly reaching the middle of the elytra in ♂, shorter in ♀. Prothorax subquadrate and very little wider than one of the elytra in ♂, much larger and strongly transverse in ♀, irregularly punctate, the disc with an oblique groove on each side of the median sulcus at the base. Elytra parallel, long, much broader in ♀,

* *T. monticola*, Gorh., from Ecuador, if the intermediate and posterior tarsi really have one of the claws cleft in ♂, must be a *Discodon*. The cleft seventh ventral segment of ♂ shows that it is not a *Telephorus*.

roughly sculptured and distinctly costate. Tarsal claws with a sharp tooth which is much shorter than the claw itself.

♂. Eighth ventral segment moderately large, oval; ninth segment semicircularly excavate, divided into two lobes, the apices of which are shorter, narrower, and more sinuate than in *P. mexicanus*, the lobes of the corresponding dorsal segment narrower and shorter, obliquely subtruncate externally. (Fig. 2.)

Length (excl. head) 9–11, breadth $2\frac{1}{2}$–$3\frac{1}{2}$ mm. (♂ ♀.)

Hab. Mexico, Ciudad in Durango (*Höge*).

One pair. Less elongate than *P. mexicanus*, the prothorax of the male much smaller and narrower, the antennae (♂) shorter, the head black in front, the terminal abdominal segments somewhat differently shaped in ♂.

Plectonotum.

Plectonotum, Gorham., Biol. Centr.-Am., Coleopt. iii, 2, p. 306 (1885) (sine descr.); in Whymper's Great Andes, Supp. App., p. 51 (1891).

Gorham's type of *Plectonotum*, *P. nigrum*, was from Ecuador, and his *P. labiale* is presumably congeneric with it. The seventh ventral segment of the latter is undivided in the male and the genus therefore cannot be very nearly related to *Silis*. The ♂ tarsal claws are uncleft. The prothorax has a thickened bead-like margin extending backward to near the acute hind angles, and it is very similarly shaped in the two sexes. *Asilis* (*Aclytia*) *tenuiculus*, Broun, from New Zealand, is very like *P. labiale*. Several species of *Plectonotum* from South America have recently been described by Pic and one from Arizona by Schaeffer.

1. **Plectonotum labiale.** (Plate VIII, fig. 50, prothorax, ♂.)

Plectonotum labiale, Gorh., Biol. Centr.-Am., Coleopt. iii, 2, p. 307.

♂. Eyes large; antennae very long, as long as or longer than the body, closely set with rather long projecting hairs; last ventral segment transverse.

♀. Eyes smaller; antennae much shorter, about reaching the middle of the elytra, clothed with shorter hairs.

Hab. Panama, Volcan de Chiriqui.

A long series seen, females as usual preponderating.

Group Silini.

The genera here placed under the Silini agree in the following characters: Seventh ventral segment of ♂ completely divided down the middle, the eighth polished and covered by the seventh; genital armature symmetric, consisting (at least in *Discodon* and *Polemius*) of several pairs of hooks or spines, which can be withdrawn within the internal sac; last joint of maxillary palpi securiform or cultriform; prothorax (except in a few species) notched at sides in ♂, and often to a less degree in ♀; elytra long. This group is abundantly represented throughout Tropical America, and includes the following genera—*Discodon*, *Polemius*, *Silis*, *Parasilis*, *Malthaster*, etc.

Discodon.

Discodon, Gorham, Biol. Centr.-Am., Coleopt. iii, 2, pp. 78 (1881), 285 (1885) (part.); Schaeffer, Journ. N. York Ent. Soc. xvi, p. 61 (1908).

The principal characters given for *Discodon* are the cleft external tarsal claws, the feebly notched sides of the prothorax, and the bilobed or divided seventh ventral segment, of the male. This definition applies to most of the species included in the genus by Gorham, but, on examination, six of them (*serricorne*, *lugubre*, *difficile*, *photinoides*, *flaccidum*, and *bivittatum*) prove to have the corresponding tarsal claws simply lobed at the base and undivided at the tip, and one of them (*serricorne*) wants the prothoracic notch. As *Discodon* (type, *D. erosum*, Gorh.) can only be separated from *Polemius*, Lec. (type, *Cantharis laticornis*, Say), by the cleft claw of one or more of the ♂ tarsi, the six species above mentioned must be transferred to Leconte's genus. Numerous forms, too, placed by Gorham under *Silis*, in his Supplement to the "Biologia," have one or more of the ♂ tarsal claws cleft, and they are here included under *Discodon*; some of these insects are closely related to *D. tenue* and *D. cinereum*, others, *D. serrigerum* and its allies, all of which have broad, serrate, tapering antennae, mimic Lycids. *D. lampyroides*, *normale*, and *luridum*, on the other hand, have the general facies of Lampyrids. Schaeffer has recently described four species of *Discodon* from the Southern United States,* and *Polemius planicollis*,

* *D. telephoroides* must be a *Polemius*.

Lec., also belongs here. The Mexican and Central American forms are divisible into three groups according to the number of cleft tarsal claws—3, 2, or 1—in ♂. The other characters given in the following table are also taken from the same sex.*

I. Anterior, intermediate, and posterior tarsi with one of the claws cleft: species Telephoriform.
  a. Anterior tarsi with the cleft claw triangularly dilated or lobed at base; prothoracic margins notched at or behind middle . . . . . *Species* 1–10.
  b. Anterior tarsi with the cleft claw more feebly dilated at base: species small or of moderate size.
    a^1. Prothoracic margins obliquely compressed at middle and notched in front of the hind angles . . . . *Species* 11.
    b^1. Prothoracic margins notched at or behind middle, the basal notch wanting . . . . . *Species* 12–25.
II. Anterior tarsi with one of the claws broadly lobed at base and the intermediate and posterior tarsi with one claw cleft.
  c. Ventral segment 7 divided into a pair of claspers; prothoracic margins notched at middle: species small . . . . *Species* 26.
  d. Ventral segment 7 simply divided down the middle.
    c^1. Antennae slender or moderately serrate; prothoracic margins notched at or behind middle: species Telephoriform, Lampyriform, or Lyciform . . . . . *Species* 27–50.
    d^1. Antennae broader and more tapering, strongly serrate: species Lyciform.
      a^2. Prothoracic margins notched at middle or at some distance before the base . . . . . *Species* 51–55.

* Except in species 6, 13, 19, 21, 54, 55, 57, 60, the females only of which are known to me.

b^2. Prothoracic margins compressed at middle and notched in front of the hind angles . . . . . *Species* 56–58.

III. Anterior and intermediate tarsi with one of the claws broadly lobed at base, and the posterior tarsi with one claw cleft; prothoracic margins notched at or behind middle: species large, Lampyriform or Telephoriform . . . . . *Species* 59–64.

Section I.

1. Discodon erosum.

Discodon erosum, Gorh., Biol. Centr.-Am., Coleopt. iii, 2, p. 79 (♂♀) (excl. the var. from Cuernavaca, ♂) (*nec* p. 285).

Elongate, shining, finely pubescent; black, the head (eyes excepted), the base of the mandibles, the prothorax, scutellum, coxae, and trochanters, and the femora to near the apex, flavous or flavo-testaceous. Eyes moderately large and prominent in ♂, smaller in ♀. Antennae very long, filiform. Prothorax transverse, bicallose on the disc behind, with strongly reflexed, sinuate margins; the latter with an oblique notch near the base in ♂, and an abrupt arcuate emargination at the basal third in ♀. Elytra very long, subparallel, wider than the prothorax. Inner claw of anterior tarsi cleft at tip and broadly, acutely triangularly dilated at base, and the outer claw of the other tarsi deeply cleft, in ♂.

♂. Eighth ventral segment broad, short, produced on each side at the apex into a long, oblique, inwardly-directed, stout, spiniform process, the tips of the two processes nearly meeting (fig. 3); [ninth segment injured by dissection] the evaginated internal sac disclosing numerous spines and a pair of stout, elongate hooks (fig. 3*a*), two other long, stout hooks remaining within the cavity.

Hab. Mexico, Toxpam and Cordova in Vera Cruz.

Redescribed from the pair from Vera Cruz named by Gorham, who did not observe the double modification of the inner anterior tarsal claw, etc., of the male. *D. erosum* must be taken as the type of *Discodon*, one claw of each tarsus being cleft in ♂; but the fissure of the claw of the anterior pair is not easily seen till the tarsus is removed. The so-called variety from Cuernavaca is a very different insect.

2. Discodon incisum.

Discodon incisum, Gorh., Biol. Centr.-Am., Coleopt. iii, 2, p. 79.

Elongate, narrow, shining, finely pubescent; testaceous, the eyes, antennae, legs (the base or greater part of the femora, and sometimes the tibiae also, excepted), and in one specimen (from Cerro Zunil) the suture and outer limb in part, black or piceous Antennae very long, subfiliform. Eyes large and prominent in ♂, smaller in ♀. Prothorax transverse, with explanate strongly reflexed margins, bicallose on disc behind; in ♂ (type) deeply angularly notched at the sides at about the basal third and slightly hollowed thence to the prominent hind angles (in immature examples with the sides abruptly arcuato-emarginate from about the middle and the hind angles, in consequence, more acute); in ♀ broader, narrowing from about the basal third, and with the margins trisinuate. Elytra very elongate, wider than the prothorax, subparallel. Inner claw of anterior tarsi triangularly dilated at base and cleft at tip, and outer claw of the other tarsi cleft at tip, in ♂. Last dorsal segment (= pygidial plate of Gorham) of ♂ greatly developed, extending beyond the comparatively short cleft seventh ventral segment.

♂. Eighth ventral segment very short, broad, broadly subtruncate at the apex, two stout hooks visible within the internal sac [ninth segment not examined].

Hab. Guatemala.

Amongst the six males of this species before me, one only (the type, from San Gerónimo) has the sides of the prothorax definitely notched, the notch in the others (which are all more or less immature) being lost in the broad arcuate emargination of the lateral margin. It is just possible, therefore, that there are two species still confused under *D. incisum*. The form of the tarsal claws was not mentioned in the original description, a character separating the present species from *D. nigripes*. *D. abdominale*, Schaeff., from Nogales, Arizona, is said to be an allied form.

3. Discodon marginatum. (Plate VIII, fig. 51, prothorax, ♂.)

Discodon marginatum, Gorh., Biol. Centr.-Am., Coleopt. iii, 2, p. 80 (*nec* p. 286).

Elongate, rather shining, finely pubescent; testaceous, the eyes black, the head with a spot on the vertex, the antennae (the base

excepted), the prothorax with a median vitta, and the elytra (the sutural and outer margins excepted) fuscous. Eyes large and prominent in ♂, smaller in ♀. Antennae long and slender. Prothorax (♂) narrow, a little broader than long, binodose on the disc before the base, deeply and abruptly sinuato-emarginate from about the middle to the sharp hind angles, and with a shallow oblique groove above at the point of interruption of the lateral margin; (♀) broader and more transverse, narrowing from near the base, the margins reflexed throughout, sinuate at the middle and near the hind angles. Elytra long, considerably wider than the prothorax, subparallel, distinctly costate on the disc. Inner claw of anterior tarsi cleft and with a sharp triangular tooth at base, and outer claw of the other tarsi cleft, in ♂.

♂. Ninth ventral segment broad, widened outwards, the apex angularly dilated on each side and produced in the middle into a broadly rounded, decumbent flap.

Hab. Guatemala, Pacific slope and Baja Vera Paz.

Twelve specimens seen, of which five are males, varying very little in colour. The Mexican examples subsequently referred to this species by Gorham have differently formed tarsal claws in the male, and they are here separated under the name *Polemius fuscovittatus*. The fissure of the inner anterior claw is not easily seen in the present species: *D. marginatum* is related to *D. erosum*, *incisum*, and *emarginatum*.

4. **Discodon emarginatum**, n. sp.

Narrow, piceous or black, the anterior portion of the head in part or entirely, the base of the mandibles, and the prothorax (a median vitta excepted) pale flavous. Antennae (♂) long, subfiliform, sparsely pilose; (♀) shorter. Eyes large and prominent in ♂, much smaller in ♀. Prothorax (♂) broader than long, arcuate in front, the sides abruptly constricted at the middle and gradually obliquely dilated thence to the acute hind angles; (♀) wider, narrowing forwards, the sides sinuate and rather broadly explanate. Elytra long, wider than the prothorax in both sexes, subparallel, sinuate at the sides in ♀. Inner claw of anterior tarsi cleft at tip and with a triangular tooth at base, and outer claw of the other tarsi cleft at tip, in ♂.

♂. Eighth ventral segment short, broad, broadly subtruncate at the apex; ninth segment widened towards the tip, which is obliquely subtruncate on either side of the middle, two strongly curved hooks

projecting from the internal sac on each side and the tip of a serrated flagellum visible in the centre (figs. 4, 4*a*).

Length (excl. head) 7–9¾, breadth 2¼–3 mm. (♂ ♀.)

Hab. Mexico (*Truqui*: ♂ ♀), Xucumanatlan in Guerrero (*H. H. Smith*: ♂), Oaxaca (*Sallé*: ♂).

Three males and one female. The Oaxaca example was found in the "Biologia" collection placed under the long series of *D. plicatum*. In the male of this insect the marginal notch of the prothorax is replaced by a deep arcuate emargination extending from the middle to the base (the hind angles thus appearing acute and prominent), and the inner claw of the anterior tarsi is cleft at the tip as in *D. erosum*. The genital armature, so far as visible, is also different from that of *D. plicatum*. *D. incisum*, Gorh., is an allied form. *D. bipunctatum*, Schaeff., from Arizona, seems to have a similarly shaped prothorax in the male.

5. Discodon carbonarium.

Discodon carbonarium, Gorh., Biol. Centr.-Am., Coleopt. iii, 2, pp. 80, 285.

Very elongate, narrow, shining, finely pubescent; nigro-piceous or black, the anterior portion of the head in part, the base of the mandibles, and sometimes the prothorax (an oblong spot or median vitta excepted) also, testaceous or rufescent. Eyes very large and prominent in ♂, much smaller in ♀. Antennae slender, as long as the body in ♂, shorter in ♀. Prothorax (♂) narrow, nearly as long as broad, abruptly sinuato-emarginate from about the middle to the prominent hind angles, binodose on the disc behind, the broad space between the callosities flattened and often carinate; (♀) broader and more transverse, narrowing from near the base, the margins narrowly reflexed and bisinuate. Elytra very elongate, wider than the prothorax, subparallel. Inner claw of anterior tarsi cleft and with a sharp triangular tooth at the base, and outer claw of the other tarsi cleft, in ♂.

♂. Ninth ventral segment broad, widened outwards, angularly dilated on each side at the apex and with the central portion broadly, subangularly produced.

Hab. Guatemala, Quiché Mts. and Cerro Zunil.

Seven specimens seen, three having the prothorax in part or almost wholly red. The male has the prothorax and tarsal claws formed very much as in *D. marginatum*

and *D. emarginatum*. *D. incisum* and *D. oppositipunctum* are also allied forms.

6. Discodon melanopterum, n. sp.

♀. Very elongate, narrow, shining, finely pubescent; deep black, the prothorax and mandibles rufo-testaceous. Antennae slender, about reaching the middle of the elytra. Prothorax narrow, broader than long, bicallose on the disc, arcuate in front, narrowing from about the basal third forwards, the margins reflexed and bisinuate, the hind angles projecting laterally, the surface comparatively smooth. Elytra much wider than the prothorax, very elongate, parallel; densely, rugulosely punctate and obsoletely costulate.

Var. *α*. Head, prothorax, scutellum, and anterior coxae rufo-testaceous. ♀.

Length (excl. head) 7–8½, breadth 2 1/10–2½ mm. (♀.)

Hab. Mexico, Omilteme [types] and Chilpancingo [var.] in Guerrero 4600–8000 ft. (*H. H. Smith*).

Four females, the variety represented by a single example from Chilpancingo. This species is closely related to *D. carbonarium*, Gorh., from the Quiché Mountains, etc. of Guatemala. The prothorax of the female of that insect is similarly shaped, but more transverse, not so smooth, and more or less infuscate. The variety is very like *Silis haematodes*, Gorh. (♀), from Guatemala; but it has the sides of the prothorax much less sinuate. The male of the present species, if correctly placed near *D. carbonarium*, should have one of the claws of each tarsus cleft at the tip.

7. Discodon oppositipunctum.

Discodon oppositipunctum, Gorh., Biol. Centr.-Am., Coleopt. iii, 2, p. 87; Pic, Mélanges exot.-entom., fasc. ii, p. 14 (1912).

Discodon schneideri, Pic, Le Naturaliste, 1910, p. 43.

Narrow, rather shining, finely pubescent; testaceous, the antennae in part or entirely, a small spot on the vertex, another on the front of the prothorax, the elytra entirely, and the knees, tibiae, and tarsi, fuscous or nigro-fuscous. Eyes large and prominent in ♂, smaller in ♀. Antennae long and slender. Prothorax (♂) nearly as long as broad, binodose on the disc behind, deeply sinuato-emarginate at the sides from about the middle to the acute, laterally prominent hind angles; (♀) transversely subquadrate, the margins feebly

trisinuate. Elytra broader than the prothorax, parallel, distinctly costate. Inner claw of anterior tarsi cleft at tip and triangularly dilated at base, and outer claws of the other tarsi cleft, in ♂.

Hab. Mexico, Cordova, Toxpam and Jalapa in Vera Cruz, Durango.

Redescribed from the immature fragmentary types (♂♀), and from a female from Durango from the Fry collection. Pic's specimens of *D. schneideri* were from Jalapa. The present species is allied to *D. marginatum* and *D. incisum*, having similarly formed tarsal claws, etc., in the male.

8. **Discodon geniculatum,** n. sp.

♂. Moderately elongate, narrow, shining, finely pubescent; the head, palpi, base of antennae, prothorax, scutellum, femora and tibiae (except at their respective apices) testaceous; the elytra and under surface fuscous, the sutural and outer margins of the former and the outer margins of the latter whitish. Head dull, densely, finely punctate; eyes rather small, prominent; antennae slender, about reaching the middle of the elytra. Prothorax slightly broader than long, subquadrate, the margins narrowly reflexed, plicate and interrupted at the middle by a long angular excision (appearing angularly dilated anteriorly), the hind angles inconspicuous. Elytra rather long, parallel, finely sculptured. Inner claw of anterior tarsi cleft at tip and with a sharp angular tooth at base, the outer claw of the other tarsi cleft at tip.

Length (excl. head) 4, breadth $1\frac{1}{8}$ mm.

Hab. Mexico, Chilpancingo in Guerrero (*Höge*).

One male. This species is not very closely related to any of the others here enumerated. It has one of the tarsal claws of each foot distinctly cleft at the tip, as in the male of *D. coarctatum*, *simplex*, *melanaspis*, etc. The pallid head, prothorax, femora (the knees excepted), and tibiae, however, separate *D. geniculatum* from *D. melanaspis* and its allies, and the comparatively smooth, differently coloured elytra, etc., from *D. coarctatum*.

9. **Discodon cinereum.**

Discodon cinereum, Gorh., Biol. Centr.-Am., Coleopt. iii, 2, p. 286 (part.); Pic, Mélanges exot.-entom., fasc. ii, p. 15 (1912).

Moderately elongate, narrow (♂), broader (♀), somewhat shining, thickly clothed with rather coarse cinereous pubescence; black, the head on each side in front, and the sides of the prothorax broadly (leaving a large, anteriorly dilated, broad black median vitta), or at least narrowly at the base, flavous or rufescent. Eyes small. Antennae subfiliform, rather stout, shorter in ♀, sparsely pilose. Prothorax (♂) subquadrate, binodose on the disc towards the base, the sides deeply, angularly emarginate at about the middle, the hind angles prominent; (♀) broader, strongly transverse, the sides trisinuate, the hind angles acute and still more prominent. Elytra moderately long, wider than the prothorax, parallel, rugosely sculptured. Inner claw of anterior tarsi cleft at the tip and with a large triangular tooth at base, and the outer claw of the other tarsi cleft, in ♂.

Length (excl. head) 4½–6, breadth 1½–2 mm. (♂ ♀.)

Hab. GUATEMALA, Calderas on the slope of the Volcan de Fuego, Quiché Mts., San Gerónimo.

Gorham confused two perfectly distinct species under *D. cinereum*, but the localities quoted and the specific name adopted could only apply to the present insect, the other, from the Quiché Mts. only, *D. nigropilosum*, having black pubescence, very long, dilated, subserrate, bristly antennae in the male, etc. The colour of the prothorax varies according to the development of the black median vitta, this latter being sometimes so extended as to leave a small space at the hind angles only flavous. Fourteen specimens seen, three of which were found placed under *Silis dilacerata* in the "Biologia" collection.

10. Discodon tenue.

Discodon tenue, Gorh., Biol. Centr.-Am., Coleopt. iii, 2, p. 286.

Narrow, slender, shining, cinereo-pubescent; nigro-piceous or black, the anterior portion of the head, the base of the antennae, the prothoracic margins (a space beyond the middle of the lateral margin in ♂ excepted), the coxae and trochanters, the basal half of the femora, and the abdomen in part, flavous or testaceous. Eyes small. Antennae slender, long. Prothorax transverse, binodose on the disc behind, abruptly constricted behind the middle in ♂, the lateral margins narrowly reflexed, the hind angles prominent; broader and with the margins strongly trisinuate in ♀. Elytra long, a little wider than the prothorax, subparallel. Inner claw of anterior

tarsi cleft at tip and with a sharp triangular tooth at base, and outer claw of the other tarsi cleft at tip, in ♂.

♂. Ninth ventral segment small, oblong, subtruncate at the tip, a single spiniform process projecting from the internal sac.

Hab. Guatemala, Quiché Mts.

Three males and five females seen, showing no variation in colour. The structure of the ♂ anterior tarsal claws was not observed by Gorham, who gives the outer claw of the middle and hind tarsi only as cleft. A narrow, slender insect related to *D. carbonarium*, which came from the same locality; but much smaller, and also differing from it in the shape of the prothorax in both sexes, the small eyes of the male, etc. The Mexican *D. subtenue* is very like *D. tenue*.

11. **Discodon maurum**, n. sp. (Plate VIII, fig. 52, prothorax, ♂.)

Discodon melancholicum, Gorh., Biol. Centr.-Am., Coleopt. iii, 2, p. 81 (part.).

♂. Narrow, finely pubescent, somewhat shining, wholly deep black. Eyes somewhat prominent. Antennae very long, filiform. Prothorax small, transverse; the sides strongly reflexed, deeply sinuate and feebly obliquely notched at about the middle, and with an abrupt notch immediately before the dentiform hind angles (these being formed by the reflexed basal margin); the disc broadly sulcate down the middle behind, appearing bicallose. Elytra wider than the prothorax, very elongate, subparallel. Inner claw of anterior and outer claw of the other tarsi cleft at tip.

Length 8, breadth 3 mm.

Hab. Mexico, Parada in Oaxaca (*Sallé*), Oaxaca (*Mus. Brit.*).

Two males—one included by Gorham under *D. melancholicum* (= *D. triste*), the other acquired by the British Museum in 1858. In the male of the present species one claw of each tarsus is cleft (not easily seen), the prothorax is small, with strongly upturned margins, and the sides abruptly notched immediately before the base, and the antennae are long and filiform, characters readily distinguishing *D. maurum* from *D. melancholicum*.

12. **Discodon nigropilosum**, n. sp.

Moderately elongate, shining, nigro-pilose; black, the sides of the prothorax narrowly (♂) or rather broadly (♀) flavous, the very

broad black median vitta sometimes extending along the anterior margin to the lateral notch in ♂. Eyes small. Antennae (♂) about as long as the body, dilated, subserrate, and densely clothed with short projecting hairs; (♀) much shorter and moderately stout, more sparsely pilose. Prothorax (♂) transverse, deeply, angularly, abruptly emarginate at the sides at about the middle (the lateral margins thus appearing dentate at the apical third), the hind angles subrectangular; (♀) shorter and more transverse, the sides somewhat rounded, narrowly reflexed, and feebly sinuate. Elytra wider than the prothorax, moderately long, slightly rounded at the sides in ♀, finely punctate and costulate. Inner claw of anterior tarsi, and outer claw of the other tarsi cleft at tip, in ♂.

♂. Eighth ventral segment narrowed to the apex, the apex itself cleft in the middle, appearing bilobed.

Length (excl. head) 5–5½, breadth 1½–2 mm. (♂ ♀.)

Hab. Guatemala, Quiché Mountains, 7000–9000 ft. (*Champion*).

Five males and two females. The black pubescence, the very long, stout, subserrate, densely pilose antennae of the male, the less parallel elytra, and the rounded, much less sinuate sides of the prothorax in the female, readily distinguish the present species from *D. cinereum*, under which the specimens described were left in the "Biologia" collection.

13. Discodon comptum.

♀. *Telephorus comptus*, Gorh., Biol. Centr.-Am., Coleopt. iii, 2, p. 90.

Hab. Guatemala, San Gerónimo in Baja Vera Paz.

Described from two females. *T. comptus*, in the absence of the male, is best placed near *Discodon nigropilosum*, also from Guatemala, it having a feebly developed head, small eyes, long, serrate antennae, and rugose elytra, much as in the female of that species; the prothorax, however, in *T. comptus* is wider than the base of the elytra, and strongly rounded and broadly explanate at the sides from near the acute hind angles. The species obviously bears no relationship to the genus *Telephorus*, s. str.

14. Discodon sinuatum, n. sp.

Moderately elongate, rather narrow (♂), broader (♀), opaque, finely pubescent; nigro-piceous or black, the prothorax sometimes

with two transversely placed reddish spots on the disc; the mandibles rufescent. Head short; eyes rather small; antennae (♂) long, slightly tapering outwards, densely set with short projecting hairs; (♀) shorter and more sparsely pilose. Prothorax (♂) transverse, densely punctulate, bicallose on the disc towards the base, the margins broadly, deeply, angularly excised behind the middle, the hind angles subrectangular; (♀) broader, with the margins simply sinuate, uninterrupted, and somewhat thickened. Elytra wider than the prothorax, subparallel in ♂, broader and distinctly explanate in ♀; densely, rugulosely sculptured, costulate in ♂. Inner claw of anterior tarsi angularly dilated at base and cleft at tip, and outer claw of the other tarsi cleft at tip, in ♂.

Var. *α*. Prothorax with a sharply defined oblique yellow streak on each side of the disc. ♂ ♀.

♂. Last dorsal segment simple; seventh ventral segment narrowly cleft throughout; eighth segment broad, transverse, notched in the middle and sinuato-truncate at the apex (fig. 5); ninth segment oblong, subtruncate at the tip, a stout hook visible on each side of it beneath and two minute hooks projecting from the internal sac.

Length (excl. head) 4½–5½, breadth 1½–2½ mm. (♂ ♀.)

Hab. Mexico (*Truqui in Mus. Brit.; Coffin in Mus. Oxon.*), Tula in Hidalgo (*Höge*).

Numerous examples of both sexes of the dark form, three only of the variety. Very like *D.* (*Silis*) *anale*, Gorh., but broader and less shining; the antennae of the male more densely pilose and the pygidium (or last dorsal segment) simple in this sex; the hind angles of the prothorax of the female not projecting laterally. The ♂ characters of the present insect are very similar to those of *D. nigropilosum*. The sexes might be mistaken for different species. Two males have been dissected.

15. **Discodon subtenue,** n. sp. (Plate III, fig. 1, ♂.)

Narrow, slender, shining, cinereo-pubescent; black, the anterior portion of the head, the base of the antennae, the prothorax (a broad median vitta or spot excepted), the coxae and trochanters, the basal half of the femora, the tibiae in part, and the margins or more of the abdomen, flavous or testaceous; the elytra (except in one ♀ example) each with an oblique discoidal stripe of variable extent (sometimes leaving only the suture and base black), and often the outer limb also, dilute testaceous; the antennae, tibiae, and tarsi (and in one immature example the anterior and intermediate femora also) rarely testaceous, the femora black in one specimen. Eyes small, prominent

in ♂. Antennae slender. Prothorax (♂) a little broader than long, binodose on the disc behind, abruptly, angularly constricted just beyond the middle and with the sides subparallel thence to the prominent hind angles; (♀) more transverse, and with the sides bi- or trisinuate. Elytra long, a little wider than the prothorax, subparallel. Inner claw of anterior tarsi, and outer claw of the other tarsi, cleft in ♂.

♂. Ninth ventral segment somewhat oval, a single spiniform process projecting from the middle of the internal sac.

Length (excl. head) 5–6½, breadth 1½–2 mm. (♂ ♀).

Hab. Mexico, Chilpancingo and Omilteme in Guerrero, 4600–8000 ft. (*H. H. Smith*).

Thirteen specimens, females predominating, varying in colour, according to the development of the oblique flavous stripe on each elytron. Very like the Guatemalan *D. tenue*, but with the sides of the prothorax broadly testaceous, and the lateral notch of the ♂ placed further forward and so abrupt as to form a dentiform prominence in front; the inner anterior tarsal claw (♂) also wants the sharp triangular tooth at the base. The single specimen (♀) with the femora and elytra black superficially resembles *D. carbonarium*.

16. **Discodon anale.** (Plate VIII, fig. 53, prothorax, ♂.)

Silis analis, Gorh., Biol. Centr.-Am., Coleopt. iii, 2, p. 304.

Elongate, narrow, somewhat shining, finely cinereo-pubescent; nigro-piceous or black, the anterior margin of the head, the base of the mandibles, and the last abdominal segment in ♂, flavous. Head short, the eyes small; antennae long, sparsely pilose, and with a stout basal joint, in ♂, slightly shorter in ♀. Prothorax (♂) transverse, bicallose on the disc posteriorly, deeply, angularly excised on each side behind the middle, the margins obliquely diverging thence to the rather prominent hind angles, thickened and reflexed in front of the emargination, and gradually converging thence to the apex; (♀) somewhat rounded and feebly sinuate at the sides, and constricted before the sharp outwardly-directed hind angles, the margins reflexed throughout, sometimes subangulate at about the apical third. Elytra long, subparallel. Inner claw of anterior tarsi, and outer claw of the other tarsi, perceptibly cleft at tip, in ♂.

♂. Last dorsal segment (= pygidium of Gorham) stout, long, tubulate, bent downward at the apex; seventh ventral segment long, broadly cleft down the middle, the lateral portions forming

two long narrow lobes; [eighth segment not examined;] ninth ventral segment widened outwards, sinuato-truncate at the tip.

Length (excl. head) 4½–5¼, breadth 1½ mm. (♂ ♀.)

Hab. Mexico (*Truqui in Mus. Brit.; Coffin, in Mus. Oxon.*), Puebla (*Sallé:* types), Chilpancingo in Guerrero (*Höge*).

A long series of this species is now available for examination, including a pair still "in copula." Various other extremely closely allied Mexican forms are known, and a fuller description is therefore required, *D. anale* being recognisable by the peculiarly shaped last dorsal segment (pygidium) of the male. Gorham seems to have overlooked the close affinity of the present insect with his *Discodon cinereum*, under which, however, he confused various species.

17. **Discodon alticola**, n. sp.

Elongate, narrow, shining, finely cinereo-pubescent; nigro-piceous or black, the sides of the head in front and the base of the mandibles testaceous. Head together with the eyes as wide as the prothorax in ♂, narrower in ♀; eyes rather large and prominent in ♂, smaller in ♀; antennae (♂) long, reaching to about the apical third of the elytra, much shorter in ♀. Prothorax (♂) slightly broader than long, bicallose on the disc posteriorly, deeply, angularly excised on each side at about the middle, the margins obliquely diverging thence to the sharp hind angles, narrowly reflexed in front of the excision, and gradually converging thence to the apex; (♀) broader, strongly transverse, with the margins thickened and reflexed to near the base and apex, obliquely converging anteriorly and subparallel or converging behind, the hind angles rather prominent. Elytra long, parallel. Inner claw of anterior tarsi, and outer claw of the other tarsi, apparently cleft at tip, in ♂.

♂. Eighth ventral segment (apex only examined) carinate down the middle, the apex narrow, feebly emarginate.

Length (excl. head) 5–5½, breadth 1½–2 mm. (♂ ♀.)

Hab. Mexico, Ciudad in Durango 8100 ft. (*Forrer, Höge*).

Three specimens. The two females captured by Forrer were found placed under *Discodon cinereum* and *carbonarium* respectively in the "Biologia" collection; the male was taken many years later by Höge at the same locality. The male approaches *D. carbonarium*, from Quiché, the dentiform lateral projection of the prothorax being much more

narrowly reflexed than in *D. anale*; the female, however, is extremely like the same sex of the last-named insect. The tarsal claws of the male appear to be simple, but in certain aspects one of them seems to be feebly cleft at the tip. In one of the females the prothorax is distinctly carinate between the dorsal callosities. *D. simplex* has duller elytra and shorter antennae.

18. **Discodon simplex,** n. sp.

Moderately elongate, narrow, somewhat shining, finely cinereo-pubescent; nigro-piceous or black, the anterior margin of the head (at the sides only in ♀), the bases of the palpi and mandibles, and the tip of the last ventral segment in ♂, testaceous. Head short, the eyes small; antennae moderately long, rather slender, subequal in length in the two sexes, the basal joint not much thickened in ♂. Prothorax (♂) transverse, bicallose on the disc posteriorly, gradually dilated from the apex to the deep, angular post-median excision, and again dilated thence to the subrectangular hind angles, the margins callose and reflexed in front of the excision (the tooth thus formed truncate behind); (♀) transversely subquadrate, the margins sinuate, armed with an oblique dentiform callosity at about the apical third, and obliquely converging thence to the apex, the hind angles acute and laterally projecting. Elytra moderately long, parallel, a little broader in ♀. Inner claw of anterior tarsi angularly dilated at base and cleft at tip, and outer claw of the other tarsi cleft at tip, in ♂.

Var. α. Prothorax with the sides broadly to near the apex, and the anterior legs in part, rufo-testaceous. ♀.

Var. β. Larger and more elongate; the entire anterior portion of the head, the palpi, the outer limb of the elytra, and the margins of the abdomen, testaceous. ♀.

♂. Seventh dorsal segment moderately long, simple, the eighth narrow and angularly excised at the tip; seventh ventral segment broadly cleft, the lateral portions bluntly rounded at the apex.

Length (excl. head) $3\frac{1}{6}$–$5\frac{1}{2}$, breadth $1\frac{1}{6}$–$1\frac{3}{4}$ mm. (♂ ♀.)

Hab. Mexico, Xucumanatlan and Amula in Guerrero, 6000–7000 ft. (*H. H. Smith*).

Described from two males and six females, the varieties being each represented by a single example; all the forms were obtained at Amula. The non-tubulate, shorter last dorsal segment of the male separates the present species from *D.* (*Silis*) *anale*, Gorh., the female, too, has a some-

what differently shaped prothorax. The var. *a* approaches *D. cinereum*, Gorh.

19. Discodon bicallosum, n. sp.

♀. Moderately elongate, shining, finely pubescent; black, the sides of the head before the eyes, a sharply defined oval spot on the front, the base of the mandibles, the basal joint of the antennae beneath, and the margins of the prothorax posteriorly, pale flavous. Head short, the eyes small; antennae moderately long. Prothorax transversely subquadrate, bicallose on the disc, feebly sinuate at the sides, the latter armed with a stout, oblique, laterally projecting, dentiform callosity towards the apex, the hind angles sharply rectangular. Elytra moderately long, parallel, much wider than the prothorax, rugulosely sculptured and subcostulate.

Length (excl. head) 4½, breadth 1⅔ mm.

Hab. GUATEMALA, San Gerónimo in Baja Vera Paz (*Champion*).

One specimen, placed in the "Biologia" collection under *D. cinereum*, a Guatemalan insect with a very differently shaped prothorax in the female. *D. bicallosum* is closely related to the Mexican *D. simplex*, from which it may be known by the peculiarly coloured head and prothorax, the latter with a stout, oblique, marginal callosity on each side towards the apex and sharply rectangular hind angles.

20. Discodon coarctatum.

Silis coarctata, Gorh., Biol. Centr.-Am., Coleopt. iii, 2, p. 303 (♂).

Silis hilara, var. ?, Gorh., loc. cit. p. 306 (part.) (specim. with black legs) (♀).

Hab. MEXICO, Cordova.

Described from five males, four of which are now in the British Museum. This insect has the prothorax of the male shaped very much as in *D.* (*Silis*) *anale*, Gorh., from which it differs in the rufo-testaceous head, prothorax, and scutellum, the less thickened lateral prominences of the prothorax, and the simple seventh dorsal segment, of the male, etc. Two examples have the head infuscate at the base. One of the two females placed by Gorham under *Silis hilara* must belong here; it is very like the same sex of the nearly allied *D. melanaspis*, but has shorter antennae, a red head, etc. The tarsi have one of their claws cleft at the tip in the male.

21. Discodon erythroderes.

♀. *Silis erythroderes*, Gorh., Biol. Centr.-Am., Coleopt. iii, 2, p. 94 [nec *S. erythrodera*, Fairm. 1893].
♀. *Silis jalapana*, Pic, L'Echange, xxvi, p. 6 (1910).
Hab. Mexico, Jalapa.

A shining, sparsely pubescent insect, with a bright red head and prothorax, and black elytra, legs, and antennae. The prothorax (♀) is subquadrate, with the narrowly reflexed lateral margins interrupted at the middle by a broad arcuate emargination (thus appearing angulate before and behind the emargination) and the hind angles prominent. Four specimens are contained in the "Biologia" collection, two of them having the head more or less infuscate at the base. *Silis jalapana* has the scutellum red, a character of no great importance. *D. erythroderes* resembles *Silis haematodes*, Gorh., in colour; but it has a very differently shaped prothorax, the latter being formed somewhat as in the male of *D. coarctatum*. The male of the present species remains to be discovered. The similarly coloured *Silis melanocephala*, Gorh., known from a single male, has a shorter prothorax, more roughly sculptured elytra, etc.

22. Discodon melanaspis, n. sp.

Moderately elongate, shining, finely and closely cinereo-pubescent; nigro-plumbeous or black, the base of the mandibles, the sides of the head in front, and the prothorax testaceous or rufo-testaceous. Eyes rather small in ♂, still smaller in ♀. Antennae long and slender in both sexes. Prothorax (♂) subquadrate, bicallose on the disc posteriorly, the margins narrowly reflexed, notched and obliquely plicate at the middle (appearing broadly subangularly dilated in front of the excision), the hind angles obtuse; (♀) broader and more transverse, the lateral margins wider, thickened throughout, feebly sinuate, constricted before the sharp hind angles, and sometimes feebly angulate towards the apex. Elytra parallel, long and broader than the prothorax in ♂, shorter in ♀, finely sculptured. Inner claw of anterior tarsi, and outer claw of the other tarsi, distinctly cleft at tip, in ♂.

Length (excl. head) $4\frac{1}{6}$–$5\frac{1}{6}$, breadth $1\frac{1}{3}$–$1\frac{1}{2}$ mm. (♂ ♀.)

Hab. Mexico (*Truqui, in Mus. Brit.*: ♂♀; *Mus. Oxon.*: ♀), Chilpancingo (*H. H. Smith*: ♀).

This is a form of *D. coarctatum* with the head (except at the sides in front) and scutellum black, and the elytra

rather finely sculptured and comparatively smooth. The description is taken from fourteen examples (three of which belong to the Oxford Museum), including a pair still "in copula." A larger female, also found by Truqui, with a broader, narrowly fusco-vittate prothorax may belong here. The fine cinereous pubescence of the elytra gives a greyish appearance to the surface.

23. **Discodon hilarum.** (Plate VIII, fig. 54, prothorax, ♂.)

Silis hilara, Gorh., Biol. Centr.-Am., Coleopt. iii, 2, p. 306 (part.) (♂ and ♀ with legs in part red).

Hab. Mexico, Cordova.

The types of *Silis hilara*, ♂ ♀, are very like *D.* (*Silis*) *coarctatum;* but the male has broader and more thickened lateral prominences, and acute hind angles, to the prothorax, and smaller eyes than in the corresponding sex of that species; the femora to near the apex, and the basal half or more of the tibiae, are testaceous; and the elytral punctuation is as coarse and distinct as in *D. pauxillum*, the cinereous pubescence, too, being long and conspicuous. The black-legged specimen (♀) placed by Gorham under the same species is here referred to *D. coarctatum*. The three tarsi have one of their claws cleft at the tip in the male.

24. **Discodon pauxillum.** (Plate VIII, fig. 55, prothorax, ♂.)

Silis pauxilla (incl. vars.), Gorh., Biol. Centr.-Am., Coleopt. iii, 2, pp. 304, 305 (excl. Zunil specimens).

Hab. Guatemala, Cubilguitz, Senahu, and San Juan in Alta Vera Paz; Panama, Volcan de Chiriqui.

The types of *Silis pauxilla*, Gorham, were from Chiriqui, and the Guatemalan examples [excluding those from Cerro Zunil, which are females with bent mandibles and are here treated as a var. of his *Silis oblita*] evidently belong to the same species. One of the varieties, that with the basal half of the femora testaceous, represented by two females, is from Vera Paz; the other, with the head (the base or a spot on the vertex excepted), the basal half or more of the antennae, and the legs in great part (the outer half of the posterior femora excepted), testaceous, is represented by numerous females from Chiriqui. The type is shining, black, with the front of the head, the base of the antennae beneath, and the prothorax (except along the anterior

margin) rufo-testaceous. The prothorax of the male is broad and transverse, and dilated at the sides into a broad, thickened, blunt tooth in front of the deep median notch; that of the female has the lateral margins feebly sinuate, and angularly dilated anteriorly, and the hind angles acute. The elytra are parallel and rather coarsely, densely punctate. The three tarsi have one of the claws cleft at the tip in the male. The second antennal joint is a little longer than usual. The eyes are small, slightly larger in the male.

25. Discodon minusculum.

Silis minuscula, Gorh., Biol. Centr.-Am., Coleopt. iii, 2, p. 305.

Hab. Guatemala, Pacific slope.

This is a form of *D. pauxillum* with a sharply and broadly nigro-vittate prothorax, the front of the head whitish, and the basal half of the femora testaceous. The male characters are similar, and the second antennal joint is rather long. *D. minusculum* comes very near the var. 1 of *D. pauxillum*, from the Atlantic slope; but as the insect seems confined to the opposite side of Guatemala, it is here retained as distinct. *D. minusculum* is represented by three males and five females in the "Biologia" collection.

Section II.

26. Discodon podabroides.

Discodon podabroides, Pic, Melanges exot.-entom., fasc. ii, p. 15 (♂) (1912).

Elongate, narrow (♂), broader (♀), rather shining, finely cinereo-pubescent; nigro-piceous or black, the sides of the head in front, the base of the mandibles, the margins of the prothorax narrowly (except at the middle), the outer limb of the elytra below the shoulder, the outer margins of the abdomen, and the tarsal claws testaceous or yellow. Head in ♂ broad, subtriangular, exserted, and with large, very prominent eyes, in ♀ less developed and with much smaller eyes; antennae slender, very long in ♂, shorter in ♀. Prothorax (♂) nearly as long as broad, bicallose on the disc towards the base, notched at the sides behind the middle, the notch limited in front by an obtuse oblong callosity, the hind angles acute and prominent; (♀) shorter and more transverse, narrowly excised

behind the dark marginal callosity, the sides obliquely converging anteriorly. Elytra considerably wider than the prothorax, long, subparallel. Inner claw of anterior tarsi lobed, and outer claw of the other tarsi cleft at tip, in ♂.

♂. Ventral segment 6 very broadly, subtriangularly emarginate; 7 drawn out laterally into a pair of long, stout, curved forceps, the acuminate apices of which overlap; 8 short, polished, glabrous, tridentate at the apex (the compressed cariniform median portion forming a prominent tooth between the two apical notches) (fig. 6); 9 narrow, produced into a long, spoon-shaped lobe on each side, the exposed median process (flagellum) finely serrate laterally and the tip of a sharp spine visible on each side of it (figs. 6*a*, 6*b*).

Length (excl. head) $5\frac{1}{2}$–6, breadth $1\frac{1}{2}$–2 mm. (♂ ♀.)

Hab. Panama, Volcan de Chiriqui (*Champion*).

Redescribed from two males and two females. Pic's type (♂), from the same source, was found by him in the Gorham collection placed under *Discodon cinereum*. The male of this insect is superficially very like a small *Podabrus*, which has differently formed tarsal claws, etc. The extraordinary ventral structure of the male was not noticed by Pic. The forcipate ventral segment is assumed to be the seventh (the first being hidden beneath the coxae) and homologous with the normally cleft last exposed segment. *D. podabroides* should perhaps be taken as the type of a separate genus.

27. Discodon plicatum.

Discodon plicatum, Gorh., Biol. Centr.-Am., Coleopt. iii, 2, pp. 79, 285 (part.).

Narrow (♂), broader (♀), elongate, moderately shining; clothed with rather long brownish or cinereous pubescence; nigro-piceous or black, the head on each side in front, the base of the mandibles, and the prothorax (a median vitta, oblong patch, or small spot on the disc excepted) straw-yellow, the humeri usually, and sometimes the scutellum also, testaceous. Eyes large and prominent (♂), smaller (♀). Antennae slender, long, sparsely pilose in both sexes. Prothorax (♂) transverse, rounded in front, deeply excavate on each side of the disc, anteriorly, the sides abruptly, angularly notched at the middle, the hind angles rectangular; in ♀ broader, with the sides simply sinuate and the hind angles obtuse. Elytra long, a little wider at the base than the prothorax in both sexes, not explanate laterally, feebly costulate on the disc. Inner claw of anterior

tarsi broadly lobed, and outer claw of the other tarsi cleft at the tip, in ♂.

Var. α. Prothorax, epistoma, and scutellum straw-yellow.

Discodon flavicolle, Gorh., loc. cit., pp. 81, 287 (excl. Panama specimens).

♂. Eighth ventral segment oval, rather broad, feebly notched in the centre at the tip; ninth segment somewhat broadly produced and subtruncate at the apex, two curved hooks projecting from the internal sac (fig. 7).

Hab. Mexico, Nuevo Leon, Vera Cruz, Oaxaca, Mexico City, etc.; Guatemala; Costa Rica.

A variable insect, recognisable amongst its allies by the position of the prothoracic notch of the male, and from *D. normale*, etc., by the form of the tarsal claws of the same sex. In the long series examined the black mark on the disc of the prothorax (which is never dilated into a cruciform patch posteriorly) becomes gradually evanescent, till it entirely disappears. The length (excluding head) varies from 8–11 mm. Five males have been dissected, three of *D. plicatum* and two of *D. flavicolle*.

28. **Discodon stramineicolle**, n. sp.

Discodon flavicolle, Gorh., Biol. Centr.-Am., Coleopt. iii, 2, p. 287 (part.).

Elongate, shining, sparsely pubescent; black or pitchy-black, the anterior half of the head, the base of the mandibles, the anterior coxae, prothorax, and scutellum pale flavous. Eyes very large in ♂, smaller in ♀. Antennae long, filiform, sparsely pilose. Prothorax transverse, arcuate in front; the lateral margins abruptly, obliquely notched at about the basal third (a dentiform projection being thus formed in front of the emargination) in ♂, and feebly sinuate in ♀; the entire basal margin strongly reflexed; the hind angles rectangular in ♂, obtuse in ♀. Elytra very long, broader at the base than the prothorax, and gradually widening from the base, faintly costulate on the disc, the margins not explanate. Inner claw of anterior tarsi broadly lobed, and outer claw of the other tarsi deeply cleft (the outer portion of the claw shorter than the inner), in ♂.

♂. Eighth ventral segment narrowly arcuato-emarginate in the middle and upturned at the apex, and produced into a dentiform projection on each side of the emargination (fig. 8); ninth segment broad, lobed towards the sides posteriorly, a stout, oblique, com-

pressed hook projecting on each side at the apex from beneath the prominent outer apical portions of the segment (fig. 8*a*).

Length (excl. head) 10–11½, breadth 3⅝–4⅛ mm. (♂ ♀.)

Hab. Panama, Volcan de Chiriqui, Bugaba.

Two males and five females. Gorham correctly surmised that the Panama examples referred by him in his "Supplement" to *D. flavicolle* (= *plicatum*, var.), were not conspecific with those from Mexico. In the Chiriqui insect the oblique lateral notch of the prothorax is placed nearer the base, and the outer claw of the middle and posterior tarsi is more deeply cleft (the two portions differing considerably in length), in the male, the basal margin of the prothorax is more reflexed, the elytra are more shining, etc.

29. **Discodon fuscipenne,** n. sp.

♂. Elongate, somewhat shining, clothed with rather long pubescence; nigro-piceous, the legs paler (due to immaturity), the points of insertion of the antennae, the base of the mandibles, the prothorax, and the anterior and middle coxae straw-yellow. Antennae long, slender, sparsely pilose. Eyes large, prominent. Prothorax transverse, arcuate in front, the sides subparallel behind, and with a narrow, oblique notch at about the basal fifth. Elytra long, subparallel, wider than the prothorax. Inner claw of anterior tarsi broadly lobed, and outer claw of the other tarsi cleft at tip, in ♂.

Ninth ventral segment narrow, a stout curved hook projecting from the internal sac on each side and a central process also visible (fig. 9).

Length (excl. head) 8½, breadth 3 mm.

Hab. Guatemala, Cerro Zunil, Pacific slope (*Champion*).

One male, included by Gorham under the series of *D. plicatum*, an insect also occurring at Cerro Zunil. The juxta-basal position of the prothoracic notch in the male readily separates *D. fuscipenne* from the same sex of *D. plicatum*, var. *flavicolle*; and the parallel-sided prothorax, with narrow notch near the base, distinguishes it from the southern *D. stramineicolle*, ♂. The prothorax is small and the elytra are very elongate, as in the last-named insect.

30. **Discodon planicolle.**

Polemius planicollis, Lec., Journ. Acad. Phil., iv, p. 17 (1858); Trans. Am. Ent. Soc. ix, p. 55 (nec *T. planicollis*, Kies.).

Discodon planicolle, Schaeff., Journ. N. York Ent. Soc., xvi, p. 61.
Telephorus platyderus, Gemm., Col. Hefte, vi. p. 120 (1870).
Discodon vitticolle, var. ?, Gorh., Biol. Centr.-Am., Coleopt. iii, 2, p. 286.

Narrow (♂), broader (♀), moderately elongate, rather shining, fusco-pubescent, nigro-piceous or black, the head on each side in front, the base of the mandibles, and the prothorax (a broad median vitta excepted), testaceous or straw-yellow, the humeri usually (to a greater or less extent), and sometimes the knees also, testaceous or flavous. Antennae long, slender, and densely pilose in ♂, shorter and sparsely pilose in ♀. Eyes rather large in ♂, smaller in ♀. Prothorax (♂) transverse, the sides notched at the middle, the hind angles rectangular; in ♀ broader, with the sides simply sinuate and the hind angles obtuse. Elytra moderately long, a little wider than the prothorax. Inner claw of anterior tarsi broadly lobed, and outer claw of the other tarsi cleft at tip, in ♂.

♂. Eighth ventral segment oval, carinate; a pair of stout hooks projecting from the internal sac.

Length (excl. head) $6\frac{1}{2}$–$7\frac{3}{4}$, breadth $2\frac{1}{4}$–$3\frac{1}{4}$ mm. (♂ ♀.)

Hab. North America, New Mexico, Texas; Mexico, Villa Lerdo in Durango, Monterey in Nuevo Leon (*Höge*), Monclova and Parras in Coahuila (*Dr. Palmer*).

This is one of the numerous forms allied to *D. plicatum*, Gorh., from which it is separable by its smaller size and less elongate shape (this being especially noticeable in the females), and by closely pilose antennae of the male. *D. filicorne*, from Durango, has similarly hirsute, but much longer, antennae in the same sex. Mr. Wickham has recently sent me a pair, and Mr. Fall a female, of the present species from Texas or New Mexico.

31. **Discodon filicorne**, n. sp.

Narrow (♂), broader (♀), dull, finely cinereo-pubescent; black, the anterior portion of the head wholly or in great part, the base of the mandibles, and the prothorax (a broad, anteriorly dilated median vitta excepted) flavous. Antennae (♂) slender, filiform, longer than the entire body, densely clothed with projecting hairs; (♀) much shorter and not so slender, sparsely pilose. Eyes moderately large and somewhat prominent in ♂, smaller in ♀. Prothorax transversely subquadrate and angularly notched at the sides a little behind the middle in ♂, broader, narrowing forwards, and with

the sides narrowly explanate and feebly sinuate in ♀. Elytra wider than the prothorax in both sexes, faintly costulate on the disc. Inner claw of anterior tarsi broadly lobed, and the outer claw of the other tarsi cleft at the tip, in ♂.

♂. Eighth ventral segment rapidly narrowed to the rounded apex, carinate down the middle; ninth segment (so far as visible) apparently shaped as in *D. plicatum*.

Length (excl. head) 7¼–7½, breadth 2⅛–3 mm. (♂ ♀.)

Hab. Mexico, Ventanas in Durango (*Höge*).

One pair. This insect is very closely allied to *D. plicatum*, which also occurs in Durango; but the extremely long, slender, densely pilose antennae, the much smaller eyes, and the narrow general shape of the male forbid any association with that species.

32. **Discodon inconstans,** n. sp.

Discodon dubium, Gorh., Biol. Centr.-Am., Coleopt. iii, 2, p. 85 (part.).

Elongate, rather narrow (♂), broader (♀), moderately shining, finely cinereo-pubescent, the prothorax with longer hairs; black, the head in front, the basal joint of the antennae in part or wholly, the base of the mandibles, the prothorax (a median vitta or spot excepted), and often the sutural and outer margins of the elytra, and the apex or outer margin of the abdomen, flavous, the disc of the prothorax in some specimens rufescent on either side of the median vitta. Eyes rather small in both sexes. Antennae rather stout, subserrate, tapering towards the tip, sparsely pilose, shorter in ♀. Prothorax transverse, as broad as, or broader than, the base of the elytra; the sides angularly notched at about the basal third in ♂, and explanate and deeply sinuato-emarginate at the same place in ♀, in fully developed specimens arcuato-ampliate before the middle. Elytra long, not explanate at the sides. Sixth ventral segment deeply triangularly emarginate at the apex in ♂, the seventh segment long, with the median fissure widening anteriorly. Inner claw of anterior tarsi broadly lobed, and the outer claw of the other tarsi cleft at tip, in ♂.

Var. *a*. Prothorax, and usually the scutellum, humeri, sutural and outer margins of the elytra, the femora at the base or entirely, and the tibiae in part, testaceous or flavous.

Discodon erosum, var., Gorh., loc. cit. p. 79 (♂).

♂. Eighth ventral segment raised at the apex and notched in the middle, the two portions appearing broadly, conjointly rounded,

the dorsal portion of the same segment truncate on each side of the median fissure (fig. 10, profile view); ninth segment subtrilobate at the tip, the pairs of long spines or hooks appearing longer or shorter according to the extent of evagination of the internal sac (fig. 10*a*.)

Length (excl. head) $8\frac{1}{2}$–11, breadth $2\frac{1}{2}$–$4\frac{1}{4}$ mm. (♂ ♀.)

Hab. Mexico, Durango, Vera Cruz, Morelos, Guerrero, Oaxaca; Guatemala, San Gerónimo; Costa Rica.

The numerous examples received from Durango and Guerrero connect the various forms of this insect. Specimens of it were found in the "Biologia" collection under *D. erosum*, *plicatum*, *normale*, and *dubium*. From *D. normale* and *D. dubium* the present species may be separated by the form of the tarsal claws of the male, and the abruptly sinuato-emarginate sides of the prothorax in the female; from *D. plicatum* by the broader prothorax, and the different position and shape of the lateral incision, as well as by the smaller eyes, in the male; and from *D. erosum* by the more dilated prothorax, with less upturned margins, the differently formed ♂ tarsal claws, etc. *D. inconstans*, too, is extremely like *D. photinoides*, Gorh., an insect occurring at the same locality in Guatemala (San Gerónimo), but differs from that species in its larger size and more elongate shape, and in having the tarsal claws of the male otherwise formed. Eleven males have been dissected, the internal sac of the aedeagus being partly or wholly evaginated in some of them.

33. **Discodon biolleyi**, n. sp.

Elongate, shining, testaceous, clothed with long pubescence, which is especially conspicuous on the prothorax; testaceous, the eyes, palpi, antennae (the base excepted), apices of the femora, tibiae in part, and tarsi infuscate or black. Eyes very large and prominent in ♂, a little smaller in ♀. Antennae very long and slender. Prothorax broader than long, arcuate in front, transversely excavate on each side anteriorly, and depressed and carinate down the middle towards the base; obliquely notched on each side just behind the middle, and with the basal portion narrowed and parallel-sided, in ♂; broader and with the margins trisinuate in ♀. Elytra long, wider than the prothorax, subparallel, the sculpture rather coarse. Inner claw of anterior tarsi broadly lobed, and outer claw of the other tarsi cleft at tip, in ♂.

Var. α. Elytra and abdomen (the apical margin of each segment excepted) black or piceous, the tibiae testaceous at the base. ♀.

Discodon erosum, Gorh., Biol. Centr.-Am., Coleopt. iii, 2, p. 285 (♀) (*nec* p. 79).

♂. Eighth ventral segment long, bluntly rounded and cleft in the middle at the tip; ninth segment long, broadly sub-bilobed at the apex, two pairs of stout hooks projecting from the internal sac (figs. 11, 11*a*).

Length (excl. head) 10, breadth $3\frac{1}{4}$–4 mm. (♂ ♀.)

Hab. Costa Rica, Cariblanco in Sarapiqui (*Biolley*: types, ♂ ♀); Panama, Volcan de Chiriqui (*Champion*: ♀, var.).

Described from the pair from Costa Rica; the female with black elytra referred to *D. erosum* by Gorham in his "Supplement" almost certainly belongs to the same species. *D. biolleyi* approaches *D. plicatum* and *D. stramineicolle*; the male has the anterior tarsal claws differently formed from those of *D. erosum*, and the prothoracic notch placed further forward.

34. Discodon vitticolle.

Discodon vitticolle, Gorh., Biol. Centr.-Am., Coleopt. iii, 2, pp. 81, 286 (excl. var. from Coahuila); Kirsch, Abhandl. Mus. Zool. Dresden, 1888–1889, No. 41, p. 8.

Rather narrow (♂), broader and with the elytra somewhat explanate (♀), shining, clothed with fine pallid pubescence; fuscous or nigro-fuscous, the head on each side in front, and sometimes the epistoma also, the base of the mandibles, the prothorax (an incomplete median vitta, often widened posteriorly, excepted), the elytra with a humeral spot or streak—in some specimens continued obliquely down the disc to near the inner apical angle—and usually the suture and outer margin also, the femora and the tibiae in part or entirely, stramineous or testaceous. Antennae slender, long, sparsely pilose, shorter in ♀. Eyes large and prominent in ♂, smaller in ♀. Prothorax with the sides angularly notched at or just behind the middle in ♂, simply sinuate in ♀. Elytra a little wider at the base than the prothorax. Inner claw of anterior tarsi broadly lobed, and outer claw of the other tarsi cleft at the tip, in ♂.

♂. Eighth ventral segment emarginate in the middle at the apex, thus appearing broadly bilobed; ninth segment gradually narrowed

towards the tip, two stout hooks projecting from the internal sac, the latter, when seen evaginated, armed with various sharp backwardly-directed spines (figs. 12, 12*a*).

Hab. Mexico, Durango, Vera Cruz, Oaxaca; Guatemala; Costa Rica; Panama; Colombia, Pasto.

A common insect in Guatemala and Panama, separable from *D. plicatum* by its more shining surface, and the testaceous femora and tibiae; the suture and outer margin of the elytra are frequently flavescent, and the pallid humeral streak is often continued as a narrow oblique stripe down the disc. Gorham described the prothorax as bright red, but not one of the long series before me shows this coloration. The three examples from Juquila in Oaxaca (♂ ♀) are larger than the rest. Five males have been dissected. The aedeagus is very similar to that of *D. plicatum*.

35. Discodon chiriquense.

Discodon photinoides, Gorh., Biol. Centr.-Am., Coleopt. iii, 2, p. 288 (*nec* p. 84).
Discodon triste, Gorh., loc. cit. pp. 82, 287 (part.).
♀. *Discodon chiriquense*, Pic, Mélanges exot.-entom., fasc. ii, pp. 14, 15 (Feb. 1912).

Narrow (♂), broader (♀), opaque, the head and prothorax shining, finely pubescent; nigro-fuscous or black, the anterior margin of the head, the base of the mandibles, the prothorax (a triangular patch of variable extent, sometimes extending to near the margin, excepted), the explanate outer margin of the elytra, and often the suture also, flavous, the humeri, the femora and tibiae in part, and the last ventral segment testaceous in some specimens. Eyes rather small in both sexes. Antennae widened, serrate, tapering outwards, very long in ♂, short in ♀. Prothorax transverse; narrow, subquadrate, and with a narrow, deep notch on each side just behind the middle; very broad, widely and abruptly explanate, and with the sides rounded and not or scarcely sinuate in ♀. Elytra in ♂ about as wide as, and in ♀ narrower than, the prothorax at the base, moderately explanate from a little below the shoulder. Inner claw of anterior tarsi broadly lobed, and outer claw of the other tarsi cleft at the tip, in ♂.

Var. ? Elytra wholly black. ♂ ♀.

♂. Eighth ventral segment cleft at the tip, appearing broadly bilobed; the evaginated internal sac, as seen from the dorsal aspect of the ninth segment, disclosing a long, slender, curved flagellum,

which is truncate at the apex, and three pairs of long, slender, curved hooks (figs. 13, 13*a*).

Length (excl. head) 6¼–7½, breadth 2½–3⅕ mm. (♂ ♀.)

Hab. Mexico, Jalapa (*Höge*), Juquila (*Sallé*); Guatemala, Sabo in Vera Paz (*Champion*: ♀); Costa Rica, La Palma (*Biolley*: ♂ ♀), Rio Sucio, Irazu (*Rogers*: ♂ ♀); Panama, Volcan de Chiriqui (*Champion*: ♂ ♀).

The above diagnosis is taken from the Costa Rica and Panama specimens, and various females from Juquila and Jalapa, Mexico, and Vera Paz, Guatemala, no doubt belong to the same species. The description of *D. chiriquense* is inadequate, but it seems to apply to the female of the present insect. The two sexes are so dissimilar that they might be taken for different species, the Lampyriform female having an unusually broad, strongly explanate prothorax, with the margins simply rounded. Three of the six males seen have been dissected.

36. **Discodon sinuaticolle,** n. sp.

Discodon triste, Gorh., Biol. Centr.-Am., Coleopt. iii, 2, pp. 82, 287 (part.).

Moderately elongate, rather broad, clothed with fine cinereous or brownish pubescence; nigro-fuscous, the anterior portion of the head, the base of the mandibles, and the prothorax (a triangular space on the disc excepted) pale flavous, the legs in part and the humeri testaceous. Eyes somewhat prominent in ♂. Antennae rather stout, tapering towards the tip, subserrate, moderately long in ♂, short in ♀, sparsely pilose. Prothorax strongly transverse, as wide as the base of the elytra, a little broader in ♀; the sides sinuate and feebly notched behind the middle in ♂, deeply sinuate in ♀. Elytra moderately long, feebly explanate, the disc obsoletely costulate. Inner claw of anterior tarsi broadly lobed, and outer claw of the other tarsi split at the tip, in ♂.

♂. Eighth ventral segment long, abruptly narrowed from about the middle, rounded and feebly cleft at the tip; ninth segment gradually narrowed, somewhat lobed on each side at the apex, a pair of long spines visible beyond it (fig. 14).

Length (excl. head) 6–7¾, breadth 2⅕–3¼ mm. (♂ ♀.)

Hab. Nicaragua, Chontales (*Belt*); Costa Rica (*Van Patten*); Panama, Bugaba (*Champion*).

Eight females and two males, placed by Gorham (but not quoted) under *D. photinoides*. A little less elongate

than *D. chiriquense*, the prothorax of the male with a shallower lateral notch, and that of the female more deeply sinuate at the sides than in the same sex of *D. photinoides*, the antennae of the male less elongate and less widened. Two males have been dissected.

37. **Discodon amplipenne**, n. sp.

Moderately elongate, broad, shining, finely pubescent; nigropiceous or black, the base of the mandibles and prothorax (a median vitta excepted) flavous, the elytral humeri sometimes testaceous. Eyes rather small in both sexes. Antennae moderately long, tapering slightly towards the tip. Prothorax transverse, arcuate in front; angularly notched on each side at the middle and narrower and parallel thence to the base in ♂, explanate and with the sides feebly sinuate in ♀. Elytra at the base about as wide as the prothorax, moderately long, broadly arcuato-ampliate from a little below the shoulder, costulate on the disc. Inner claw of anterior tarsi broadly lobed, and outer claw of the other tarsi deeply cleft, in ♂.

Var. *a*. Prothorax entirely flavous. ♀.

♂. Eighth ventral segment long, oval, rounded and slightly reflexed at the tip; ninth segment oblong, subparallel-sided, the apex produced in the middle, subtruncate on each side, and angulate externally, two hooks projecting from the internal sac (fig. 15).

Length (excl. head) 9–9¾, breadth 3½–4½ mm. (♂ ♀.)

Hab. Mexico, Cuernavaca in Morelos, Juquila in Oaxaca (*Sallé*).

Described from two pairs from Cuernavaca and a female of the variety with immaculate prothorax from Juquila, the former included by Gorham under *D. plicatum* and the latter under *D. difficile*. The dilated elytra, and the small eyes and differently-shaped ninth ventral segment of the male, distinguish *D. amplipenne* from *D. plicatum*, the prothorax of which varies in colour in a similar way. From similarly-coloured *D. luridum*, ♂, the present species may be separated by the narrower prothorax, with differently placed median notch, and the cleft outer intermediate tarsal claw.

38. **Discodon cleroides.**

Discodon cleroides, Gorh., Biol. Centr.-Am., Coleopt, iii, 2, p. 84 (♂ ♀) (part.) (*nec* p. 287).
Telephorus cleroides, Gorh., loc. cit. pl. 5, fig. 18 (♀).

Rather broad, black, the anterior margin of the head, the mandibles in part, a broad oblique submarginal stripe on each side of the prothorax, and sometimes the last two ventral segments, yellow. Eyes not prominent. Antennae short, stout, serrate, tapering towards the tip. Prothorax strongly transverse; in ♂ subquadrate, widened posteriorly, and with a deep, narrow, abrupt notch on each side just behind the middle; in ♀ broader, explanate, the sides rounded, sinuate at about the middle. Elytra more or less explanate from a little below the shoulder. Inner claw of anterior tarsi broadly lobed, and outer claw of the other tarsi split, in ♂.

♂. Internal sac, as seen evaginated, disclosing an extremely long, acuminate, bisinuate flagellum, a shorter, stout, curved tube beneath it, and three very long, hook-like processes on each side. (Figs. 16, 16*a*.)

Hab. GUATEMALA, Dueñas and Purula.

In the pair from Dueñas the last two ventral segments are flavescent, the smaller example (♀) from Purula having the abdomen black. The intermediate tarsal claws are now wanting in the unique male, but Gorham says the outer one is not lobed. The Mexican *Polemius nigromarginatus* and *P. nigrolimbatus* are similarly coloured forms, but the males of these insects have one of the claws of each foot simply lobed at the base, and none of them cleft.

39. Discodon melancholicum.

Discodon melancholicum, Gorh., Biol. Centr.-Am., Coleopt. iii, 2, p. 81 (excl. Parada specimen).
Discodon triste, Gorh., loc. cit. pp. 82, 287 (specimens from Guanajuato and San Luis Potosi only).

Rather shining, black, the prothorax usually in part flavous or rufescent at the sides (leaving a large cruciform black patch or median vitta on the disc black), in some specimens entirely black. Antennae (♂) long, subserrate, closely set with short bristly hairs, slightly tapering towards the tip; (♀) shorter and more slender, sparsely pilose. Prothorax of ♂ with the sides slightly notched at about the middle and subparallel thence to the rectangular hind angles, of ♀ moderately explanate and very feebly sinuate, and with the hind angles obtuse. Elytra about as wide as the prothorax at the base, and at most very feebly explanate. Inner claw of anterior tarsi broadly lobed, and outer claw of the other tarsi cleft at the tip, in ♂.

♂. Eighth ventral segment carinate, rounded and feebly cleft at

the tip; ninth segment subtrilobate at the apex and deeply excavate anteriorly on each side of the convex central portion, two stout hooks projecting from the internal sac (fig. 17).

Hab. Mexico, San Luis Potosi, Durango, Guanajuato, Michoacan, Puebla, Guerrero, and Mexico City.

Gorham correctly surmised that his *D. triste*, which is an abundant insect on the highlands of Mexico, was not specifically distinct from *D. melancholicum* (from Guanajuato and Michoacan), the latter simply having the lighter-coloured portions of the prothorax obscurely rufescent or wanting, the characteristic cruciform black patch on the disc being, however, clearly visible in the example marked "type." The specimens quoted by him under *D. triste* from all the localities south of Mexico belong to other species, as well as the one from Parada, Oaxaca, placed under *D. melancholicum*. Fresh examples of the male have the antennae densely setulose as in *D. nigropilosum*. Five specimens of this sex have been dissected, showing the peculiar shape of the ninth ventral segment. A long series of the form described as *D. triste* has been received from the neighbourhood of the city of Mexico; the typical *D. melancholicum*, with darker prothorax, is apparently rare. Schaeffer (Journ. N. York Ent. Soc. xvi, p. 61) incorrectly refers this species to *Polemius*.

40. **Discodon atronitens**, n. sp.

Rather broad, shining, finely pubescent; black, the sides of the head in front, the base of the mandibles, the anterior and lateral margins of the prothorax, and sometimes the explanate margins of the elytra in part, the humeri, and the last two ventral segments (in both ♂ and ♀), flavescent or reddish. Head rather broad, the eyes somewhat prominent in ♂; antennae short in ♀, longer in ♂, rather stout, subserrate, tapering towards the tip, joint 3 as long as 4. Prothorax transverse, broadly rounded at the apex; the sides subparallel towards the base, deeply, obliquely notched at about the basal third in ♂, simply sinuate and narrowly explanate in ♀, the hind angles rectangular; the surface uneven, closely, finely punctate, smoother on the disc. Elytra wider than the prothorax, coriaceous, moderately explanate from a little below the base in both sexes. Inner claw of anterior tarsi broadly lobed, and outer claw of the other tarsi deeply cleft, in ♂.

♂. Eighth ventral segment oblong, broadly rounded at the apex,

and with a minute projection on each side of the longitudinal median groove at the tip.

Length (excl. head) 9–10½, breadth 3¾–4½ mm. (♂ ♀.)

Hab. W. Mexico, Xucumanatlan and Amula in Guerrero, 6000–7000 ft. (*H. H. Smith*).

Eleven specimens, all females but two, varying in the development of the flavous margin to the prothorax and elytra, which may be almost wholly wanting, and in the colour of the apex of the abdomen, the latter being usually black. Very like *D. melancholicum*, Gorh., but with the prothorax of the male deeply and abruptly notched at the sides at about the basal third, and the elytra explanate at the sides in both sexes.

41. **Discodon funereum**, n. sp.

Elongate, opaque, wholly black, nigro-pilose. Eyes moderately large and prominent in ♂, small in ♀. Antennae very long, somewhat dilated, and subserrate in ♂, comparatively short and tapering outwards in ♀. Prothorax (♂) narrow, subquadrate, bicallose on the disc behind, the margins with a deeply-cut angular notch at the middle and parallel thence to the rectangular hind angles; (♀) strongly transverse, broad, the margins reflexed and feebly bisinuate, the hind angles obtuse. Elytra much wider than the prothorax, subparallel, and unusually elongate in ♂, explanate laterally and not much wider than the prothorax in ♀, roughly punctate and feebly costulate. Inner claw of anterior tarsi lobed at base, and outer claw of the other tarsi cleft, in ♂.

♂. Eighth ventral segment oblong, parallel-sided, rounded and reflexed at the tip; ninth segment feebly trilobed at the apex.

Length (excl. head) 8, breadth 3–3½ mm. (♂ ♀.)

Hab. Mexico, Ciudad in Durango, 8000 ft. (*Höge*).

One pair. The male of this insect is not unlike the same sex of *D. carbonarium*, Gorh., from which it may be known by its larger size and rougher sculpture; the widened, subserrate antennae and the differently-shaped prothorax and tarsal claws of the male, etc. The female is very dissimilar in appearance. *Polemius niger*, Schaeff., from the Huachuca Mts., Arizona, described from a single female example, seems to come very near *D. funereum* and *D. melancholicum*; but in the absence of the male it is impossible to speak with any certainty.

42. **Discodon nigropiceum,** n. sp.

Moderately elongate, widened posteriorly, finely cinereo-pubescent, the head and prothorax shining, the elytra dull; nigropiceous, the sides of the head in front and the base of the mandibles flavous. Eyes small. Antennae very long, somewhat widened, and subserrate in ♂, shorter and tapering in ♀. Prothorax (♂) subquadrate, the margins with a deeply-cut angular notch at the middle and parallel thence to the rectangular hind angles; (♀) strongly transverse, semicircular, wider than the base of the elytra, the margins broadly explanate and reflexed. Elytra moderately long, at the base in ♂ much wider than, in ♀ not quite so broad as, the prothorax, feebly explanate laterally in ♂, broadly so in ♀, roughly punctate and faintly costulate. Inner claw of anterior tarsi lobed at base, and outer claw of the other tarsi cleft (the outer section of the claw shorter than the inner), in ♂.

Length (excl. head) $5\frac{1}{2}$–$7\frac{1}{2}$, breadth $2\frac{1}{10}$–4 mm. (♂ ♀.)

Hab. Mexico, Ventanas in Durango (*Höge*).

One pair, the female Lampyriform and very different from the male, but almost certainly belonging to the same species. Much less elongate than *D. funereum*, the head and prothorax smoother and shining, the pubescence finer and not black, the elytra of the male less parallel and that of the female dilated (much as in *D. amplipenne*), the sides of the prothorax of the female broadly reflexed. The elytra of the latter have been flattened in some way and appear broader than they really are.

43. **Discodon divisum,** n. sp. (Plate III, fig. 2, ♂.)

Moderately elongate, shining, finely pubescent; testaceous or flavo-testaceous, the basal half of the head, the eyes, the antennae (except the basal joint wholly or in part), a large elongate patch at the apex of each elytron (sometimes extending over nearly the apical half), the sterna, abdomen (the margins excepted), and legs in part or almost entirely (the base of the anterior femora excepted) black. Eyes large and prominent in ♂, smaller in ♀. Antennae long and subserrate in ♂, shorter and slender in ♀. Prothorax (♂) transverse, the sides notched at the basal third, rounded anteriorly, and parallel from the notch to the base; (♀) broader and with a shallower lateral notch, the hind angles obtuse. Elytra moderately long, wider than the prothorax, subparallel in ♂, slightly explanate from a little below the shoulder in ♀. Inner claw of anterior tarsi broadly lobed, and outer claw of the other tarsi cleft, in ♂.

♂. Eighth ventral segment rapidly narrowed outwards, the apex narrow and cleft at the middle.

Length (excl. head) $7\frac{1}{2}$–$8\frac{1}{2}$, breadth $2\frac{4}{5}$–$3\frac{1}{2}$ mm. (♂ ♀.)

Hab. Mexico, Chilpancingo in Guerrero (*Höge*, *H. H. Smith*), Cuernavaca in Morelos (*Höge*).

Eight males and five females, varying a little in the colour of the legs and apices of the elytra, according to the development of the black portions of the surface. *D. rufipes*, from Oaxaca, is a nearly allied form.

44. Discodon nigripes.

Discodon nigripes, Gorh., Biol. Centr.-Am., Coleopt. iii, 2, p. 80.

Elongate, a little widened posteriorly, shining, clothed with rather long pubescence, this being conspicuous at the sides of the prothorax in ♂; reddish-ochraceous or testaceous, the antennae, eyes, legs, and under surface, and the head in great part or entirely in the Mexican examples, black. Eyes large in ♂, smaller in ♀. Antennae long and slender. Prothorax transverse, the margins with a narrow oblique notch at about the middle in ♂; broader and simply sinuate at the sides in ♀. Elytra elongate, wider than the prothorax, somewhat widened posteriorly, distinctly costate. Inner claw of anterior tarsi with a broad triangular lobe, and outer claw of the other tarsi cleft at tip, in ♂.

Var. *a*. Prothorax with an abbreviated median vitta, and the elytra with a common, broad, gradually narrowed, sutural stripe extending from the base to near the apex nigro-piceous, the head wholly black. ♀.

♂. Ninth ventral segment narrow, produced in the middle at the apex, two stout hooks visible within the internal sac.

Hab. Mexico, Tepetlapa and Chilpancingo in Guerrero (*H. H. Smith*), Cuernavaca in Morelos (*Höge*, *H. H. Smith*), Capulalpam and Panistlahuaca in Oaxaca (*Sallé*); Guatemala, Las Mercedes [type], Volcan de Atitlan (*Champion*).

A good series of this species is now available for examination, including numerous specimens from Mexico, one of which was labelled (but not quoted) by Gorham. The black legs and under surface, the position of the prothoracic notch, and the form of the anterior tarsal claws of the male, separate *D. nigripes* from *D. incisum*. The variety is represented by a single example from Panistlahuaca. A wholly testaceous female from Oaxaca (*Sallé*) may belong here.

45. **Discodon rufipes**, n. sp.

Discodon rufipes, Gorh., in litt.

Moderately elongate, finely pubescent; nigro-piceous or black, the anterior portion of the head, the basal joint of the antennae, the prothorax and scutellum, the sides of the elytra to near the apex, and in one specimen nearly the basal half of the disc also, and the legs (the tarsi and apices of the tibiae excepted) testaceous or flavo-testaceous. Antennae long and slender in both sexes. Eyes rather small, a little larger and more prominent in ♂. Prothorax (♂) slightly broader than long, arcuate in front, the sides narrowly and somewhat deeply notched at about the basal third, and parallel thence to the rectangular hind angles; (♀) broader and more transverse, narrowing from near the base, the sides explanate, reflexed, and strongly sinuate. Elytra wider than the prothorax, subparallel in ♂, slightly dilated from a little below the shoulder in ♀. Inner claw of anterior tarsi broadly lobed, and outer claw of the other tarsi cleft, in ♂.

♂. Eighth ventral segment oblong, broadly rounded at the tip.

Length (excl. head) $7\frac{1}{2}$–$8\frac{1}{4}$, breadth 3–$3\frac{1}{2}$ mm. (♂ ♀.)

Hab. Mexico, Juquila in Oaxaca (*Sallé*).

One male and two females. This species looks like a form of *D. divisum* with the black portion of the elytra showing a tendency to extend forwards to the base. The male, however, has the prothorax more rounded at the apex and the lateral notch much deeper, the antennae more slender, and the eighth ventral segment differently shaped; the female, too, has the prothorax narrowed from near the base, with the margins reflexed and bisinuate, instead of notched as in the same sex of *D. divisum*.

46. **Discodon duplovittatum**, n. sp.

Moderately elongate, widened posteriorly, shining, finely pubescent; the head between the eyes, the antennae, two vittae on the disc of the prothorax, the legs (except the anterior and intermediate coxae, trochanters, and femora to near the tip in ♂), and under surface black, the rest of the surface testaceous. Antennae long, slender. Eyes large in ♂, smaller in ♀. Prothorax (♂) nearly as long as broad, subquadrate, arcuate in front, the sides shallowly, obliquely notched at about the middle and slightly divergent thence to the subrectangular hind angles; (♀) broader, with the sides feebly sinuate at the basal third and gradually convergent thence to

the apex. Elytra wider than the prothorax, moderately explanate from a little below the shoulder, roughly punctate and distinctly costate. Inner claw of anterior tarsi broadly lobed, and outer claw of the other tarsi cleft at tip, in ♂.

Length (excl. head) 7–7½, breadth 3–3⅛ mm. (♂ ♀.)

Hab. Mexico (*Truqui, ex coll. Fry, Mus. Brit.*).

One pair. Not unlike *D. luridum*, Gorh., but much smaller and narrower, the prothorax bivittate (as in *D. bivittatum*), the elytra distinctly costate and much less explanate, the outer claw of the intermediate and posterior tarsi cleft at the tip in ♂, the prothoracic notch of the ♂ placed at the middle. From the similarly-coloured variety of *D. bivittatum* the present species may be known by the differently-shaped prothorax, with less reflexed margins, the form of the tarsal claws, etc.

47. **Discodon testaceipenne**, n. sp.

♂. Moderately elongate, widened posteriorly, shining, finely pubescent; black, the sides of the head in front, the base of the mandibles, the prothorax (a median vitta excepted), and elytra testaceous. Eyes rather small. Antennae nearly as long as the body, somewhat widened, serrate, slightly tapering outwards. Prothorax nearly as long as broad, arcuate in front; the sides abruptly, obliquely notched just behind the middle, and gradually divergent thence to the prominent hind angles, appearing obtusely dentate in front of the emargination. Elytra wider than the prothorax, gradually widened from a little below the shoulder, costate on the disc. Inner claw of anterior tarsi broadly lobed, the outer claw of the other tarsi cleft.

♂. Ninth ventral segment oblong, trilobed at the apex, the central portion narrowly produced, leaving a slender, obliquely projecting spine visible on each side.

Length (excl. head) 6½, breadth 2⅔ mm.

Hab. Mexico, Ventanas in Durango (*Höge*).

One male. Very like the same sex of *D. duplovittatum*, but with a single vitta on the prothorax and the lateral notch deeper (appearing angulate in front of the emargination), the head and eyes smaller, the antennae broader and more distinctly serrate. It is much smaller and narrower than the similarly coloured *D. luridum*, Gorh., and has the prothoracic notch placed further forward and the outer claw of the intermediate tarsi cleft.

48. Discodon calidum.

Discodon calidum, Gorh., Biol. Centr.-Am., Coleopt. iii, 2, p. 285 (♂♀).

Rather broad, shining, clothed with long pubescence; ochreo-testaceous, the antennae (joints 8–11 excepted), eyes, a triangular mark on the vertex of the head, a narrow median vitta on the prothorax, the knees, tibiae, tarsi, and abdomen black. Antennae long, serrate, rather stout, much narrowed towards the tip. Eyes moderately large in ♂, smaller in ♀. Prothorax transverse, arcuate in front, somewhat widened towards the base; the sides obliquely notched a little behind the middle in ♂, and emarginate in the same place in ♀. Elytra long, at the base slightly wider than the prothorax, moderately explanate from a little below the shoulder, feebly costulate on the disc, the colour somewhat modified by the close ochreous pubescence. Inner claw of anterior tarsi broadly lobed, and outer claw of the other tarsi deeply cleft, in ♂.

♂. Eighth ventral segment broad, rather long, broadly rounded and distinctly dentate on each side at the apex (fig. 18); ninth segment subtrilobed at the tip, a long, stout, compressed hook projecting from it on each side at the apex (fig. 18*a*).

Hab. Panama, Volcan de Chiriqui.

One male and two females seen. Larger and broader than *D. nigripes*, the prothorax vittate, the terminal three joints of the antennae, and the femora to near the tip, testaceous. *D. calidum* has the general facies of a Lycid. It is closely related to *D. purpurascens*, a fact not observed by Gorham.

49. Discodon purpurascens.

Discodon purpurascens, Gorh., Biol. Centr.-Am., Coleopt. iii, 2, p. 87.

Silis (?) *purpurascens*, Gorh., loc. cit. pl. 5, fig. 23 (♀).

Broad, widened posteriorly, closely pubescent, the pubescence partaking of the ground-colour; black, the head (except a large triangular patch on the vertex, which extends outwards to the eyes) and prothorax (a median vitta excepted) testaceous or rufo-testaceous, the elytra bright red. Eyes rather small, prominent in ♂. Antennae moderately long, dilated, serrate, tapering outwards. Prothorax (♂) transverse, arcuate in front, parallel-sided at the base, the margins abruptly notched behind the middle; (♀) broader, narrowing from the base, the margins sinuate at about the basal

third. Elytra at the base slightly wider than the prothorax, somewhat explanate from a little below the shoulder, rather coarsely sculptured. Tarsi dilated, the anterior pair broader in ♂; inner claw of anterior pair broadly lobed, and outer claw of the others cleft, in ♂.

♂. Eighth ventral segment emarginate in the middle at the apex, the latter appearing broadly bilobed; internal sac, as seen partially evaginated, disclosing a long, acute, backwardly projecting spine on each side, and various other slender spines in the centre. (Fig. 19.)

Hab. Costa Rica.

Redescribed from the types, the male, as stated by Gorham, being discoloured and completely abraded, the female, on the contrary, is in perfect condition. The wholly black legs and antennae, the basally widened prothorax of the female, and the genital armature of the male, separate *D. purpurascens* from *D. calidum*. The female might easily be mistaken for a Lycid; it has the elytral pubescence scarlet.

50. Discodon histrio.

Discodon histrio, Gorh., Biol. Centr.-Am., Coleopt. iii, 2, p. 86, pl. 5, fig. 22 (♀, not ♂ as quoted) (*nec* p. 288).

Moderately elongate, widened posteriorly, shining, finely pubescent; black, some markings on the front of the head, the base of the mandibles, the sides of the prothorax broadly, and an elongate humeral patch on the elytra, ochreous or rufo-testaceous. Eyes rather small, a little larger and prominent in ♂. Antennae moderately long, subserrate, tapering towards the tip. Prothorax (♂) subquadrate, arcuate in front, obliquely notched on each side at the middle; (♀) broader and more transverse, the sides sinuate and converging from near the base. Elytra considerably wider than the prothorax, widened from a little below the shoulder, rugosely punctured and distinctly costate. Inner claw of anterior tarsi broadly lobed, and outer claw of the other tarsi cleft, in ♂.

♂. Eighth ventral segment oblong, narrowing outwards, rounded and notched in the middle at the apex, the dorsal portion of the same segment short, broadly bilobed at the tip, two stout hooks projecting from the internal sac. (Fig. 20.)

Hab. Guatemala, Capetillo and Dueñas.

Redescribed from two females and one male. The

specimen figured by Gorham is a female, not a male as stated. A Lyciform insect, very like some of the species placed by him under *Silis*, e. g. *S. lycoides*, *varians*, etc. It is perhaps nearest allied to *D. purpurascens*, which has broader tarsi, red elytra, etc. The male from Coahuila, Mexico, quoted on p. 288 of the "Biologia," which cannot now be found, must have belonged to a different species.

51. **Discodon cardinale,** n. sp. (Plate III, fig. 3, ♂.)

Elongate, narrow (♂), broader (♀), opaque, thickly pubescent; black, the sides of the head in front, the base of the mandibles, and the tarsal claws testaceous or rufo-testaceous, the prothorax (a narrow median vitta excepted) and elytra (except along the sutural margin anteriorly) brick-red, the vestiture of the latter similarly coloured. Head rather small, obliquely narrowed behind the eyes, the latter prominent; antennae about reaching the middle of the elytra, very broadly dilated from joint 3 in both sexes, 7–11 rapidly narrowing outwards. Prothorax (♂) transversely subquadrate, very gradually narrowed from the base forwards, and with the margins shallowly notched at about the basal fourth; (♀) broader, more rounded at the sides, and more rapidly narrowed from the base, the margins conspicuously hollowed at the basal fourth. Elytra long, a little wider than the prothorax, broader in ♀, flattened on the disc, faintly tricostate, the sculpture hidden by the vestiture. Inner claw of anterior tarsi broadly lobed, and outer claw of the other tarsi cleft at tip, in ♂.

♂. Eighth ventral segment oblong, narrowed outwards, rounded and cleft in the middle at the apex, two stout hooks projecting from the internal sac.

Length (excl. head) 7½–9½, breadth 2½–3½ mm. (♂ ♀.)

Hab. Mexico, Atoyac in Vera Cruz (*H. H. Smith*).

One pair. A Lyciform insect related to the Costa Rican *D. purpurascens*, Gorham, but much smaller and narrower, and with the antennae as broadly dilated in both sexes as in various species placed by that author under *Silis*, e. g. *S. serrigera*, *plateroides*, etc. These latter are here placed under *Discodon*, their respective males having one of the claws of the intermediate and posterior tarsi cleft.

52. **Discodon subulicorne,** n. sp. (Plate III, fig. 4, ♂.)

Moderately elongate, widened posteriorly, rather dull, finely pubescent; nigro-piceous or black, the sides of the head in front,

the base of the mandibles, the sides of the prothorax broadly, and about the basal third of the elytra (♂), or a humeral streak (♀), ochreous or rufo-testaceous. Eyes small. Antennae moderately long, broadly dilated and subserrate, rapidly tapering outwards. Prothorax (♂) strongly transverse, arcuate in front, parallel-sided from the narrow oblique lateral notch, which is placed at about the basal fourth, to the rectangular hind angles; (♀) simply sinuate before the base, and with the sides arcuately converging thence to the apex. Elytra moderately dilated from a little below the shoulder, rugulosely sculptured and conspicuously costate. Inner claw of anterior tarsi broadly lobed, and outer claw of the other tarsi cleft at tip (the outer section of the claw shorter than the inner), in ♂.

Length (excl. head) 8¼–9, breadth 3–3¾ mm. (♂ ♀.)

Hab. Guatemala, Capetillo and Dueñas (*Champion*).

One pair, the female with the elytra infuscate, the humeral streak excepted. These insects were left by Gorham under *D. histrio*, which was from the same localities in Guatemala, and labelled by him *Discodon* sp. The broadly dilated, rapidly tapering antennae, the short prothorax, with the lateral excision of the male placed much nearer the base, etc., readily separate *D. subulicorne* from *D. histrio*. The elytra vary in colour, as in the species described by Gorham under the names *Silis varians*, *serrigera*, etc.

53. **Discodon combustum.** (Plate VIII, fig. 56, prothorax, ♂.)

Silis combusta, Gorh., Biol. Centr.-Am., Coleopt. iii, 2, p. 293 (♂ ♀).
Silis varians, Gorh., loc. cit. p. 92 (♀) (part.).
Polemius (?) *combustus*, Schaeff., Journ. N. York Ent. Soc. xvi, p. 62.

♂. Eyes large; antennae long, joints 3–11 moderately dilated, subserrate, tapering towards the tip; prothorax a little broader than long, arcuate in front, obliquely compressed on each side of the disc anteriorly, the margins deeply notched at the middle, and subparallel and scarcely reflexed thence to the subrectangular hind angles; anterior and intermediate tarsi dilated; inner claw of anterior tarsi strongly lobed at base, the outer claw of the other tarsi cleft at tip.

♀. Eyes smaller; antennae with joints 3–7 much broader, 8–11

rapidly narrowing, 9 and 10 narrow; prothorax broader, strongly transverse, narrowing from near the base, the margins notched in front of the prominent hind angles.

Hab. Guatemala, Teleman and Chacoj in the Polochic valley.

Four males and seven females seen, varying in the colour of the prothorax and elytra, the latter wholly ochraceous or with the apical half black, the black extending forwards in one specimen so as to leave only the shoulders pale. The prothorax is always vittate. The male has the prothorax shaped as in many species of *Discodon*; the female is very like that of *D. serrigerum*, but it has a slightly shorter prothorax and the antennae not quite so long.

54. Discodon plateroides.

♀. *Silis plateroides*, Gorh., Biol. Centr.-Am., Coleopt. iii, 2, p. 291.

Hab. Panama, Bugaba.

Described from three females. The two reserved for the "Biologia" collection are very like the corresponding sex of the Mexican *D. cardinale*, and also have broadly dilated tapering antennae; but in the present insect the prothorax, scutellum, elytra, femora, and basal half of the tibiae are ochraceous, the prothorax is broader, more dilated at the sides, and has the shallow emargination in front of the hind angles more extended forwards (the margins being bisinuate before the base in *D. cardinale*), and the elytra are more dilated posteriorly. The male of *D. plateroides* will doubtless prove to have the general structure of the same sex of *D. cardinale*. Gorham notes the close resemblance to the Lycid *Plateros rubricatus*.

55. Discodon diversum.

Silis diversa, Gorh., Biol. Centr.-Am., Coleopt. iii, 2, p. 292 (♀).

Hab. Panama, Bugaba.

Described from two females. Broader, more widened posteriorly, and more shining than *D. serrigerum* (♀), the apical three joints of the antennae, the prothorax, and femora ochraceous; the prothorax smoother and broader, less narrowed anteriorly, and feebly bisinuate at the sides

posteriorly; the elytra smoother at the base, granulate towards the apex.

56. **Discodon varians.** (Plate VIII, fig. 57, prothorax, ♂.)

Silis varians, Gorh., Biol. Centr.-Am., Coleopt. iii, 2, pp. 92, 291 (part.) (excl. fig.).

♂. Eyes rather small; antennae moderately long, joints 3–11 dilated, serrate, and canaliculate, rapidly tapering outwards; prothorax transverse, subcampanulate, obliquely compressed on each side of the disc anteriorly, the margins narrowly reflexed and obliquely notched just in front of the prominent hind angles; elytra about as broad at the base as the prothorax, more or less widened posteriorly; inner claw of anterior tarsi with a broad angular lobe at the base, the outer claw of the other tarsi cleft at tip.

♀. Eyes less prominent; mandibles curved; antennae with joints 3–8 very broadly dilated, subserrate, 9–11 rapidly narrowing; prothorax broader, arcuately narrowing anteriorly, the sides with a longer and shallower notch in front of the hind angles.

♂. Ninth ventral segment elongate, produced in the middle at the tip, two pairs of stout hooks projecting from the internal sac. (Fig. 21.)

Hab. Mexico, Cordova [♀], Jalapa [♀], Teapa [♀], Juquila [var. ♂]; Guatemala, San Joaquin in Alta Vera Paz [type, ♂], Dueñas [♂ ♀], San Isidro [♂].

Gorham originally included, as he himself states (loc. cit. p. 291), several species under his *Silis varians* (mainly owing to the absence of males of some of the forms); but in his "Supplement" he fixes as type a male from San Joaquin, and says that the true *S. varians* has shorter antennae than *S. serrigera*, and (on p. 92) he notes that the prothorax is minutely notched immediately before the hind angles in both sexes. These characters bring *D.* (*Silis*) *varians* very near *D. serrigerum*, from which it may be separated by its relatively shorter prothorax, the shorter antennae and the more broadly lobed inner anterior tarsal claw of the male. The ten examples before me vary in the development of the ochreous basal portion of the elytra, this being reduced to a humeral spot in the var. from Juquila and in one specimen from Zapote. The examples from the other localities quoted by Gorham belong to different species.

57. **Discodon mexicanum.**

Silis mexicana, Pic, Bull. Soc. Ent. Fr. 1909, p. 346.

Hab. Mexico, (*coll. Pic*).

Pic describes this insect as near *Silis praemorsa*, Gorh. (= ♂ of *S. lycoides*), differing from it in having the prothorax but little incised laterally and the head more broadly black: elongate, rather shining, black; the head in part, the sides of the prothorax, and the humeral callus flavous; antennae moderately long, slightly thickened at the base, attenuate at the apex; prothorax transverse, with the sides subarcuate anteriorly, almost straight posteriorly, and feebly emarginate behind; elytra broader than the prothorax, long, dilated towards the middle, densely, rugulosely punctate.

The sex is not stated, and as the colour of the elytra is variable, and of no value as a specific character, in these Lyciform insects, it is impossible to certainly identify *Silis mexicana* from the incomplete description: it may be a male of *D.* (*Silis*) *varians*, or of an allied form of which we have various females from Mexico, etc., left doubtfully placed by Gorham under *S. varians*, *lycoides*, and *nodicollis*. Five of these females (from Toxpam, Jalapa, Cordova, San Juan, and San Gerónimo) have the apical half or more of the elytra, and the suture thence to the base (in part or entirely), a dorsal vitta on the prothorax, and the head in part, black; the mandibles long and abruptly bent; the antennae rather short, stout, greatly dilated from the third joint, tapering towards the apex; the prothorax transverse, subquadrate, uneven, the margins dilated, reflexed, and trisinuate (appearing subangular anteriorly), the hind angles prominent; the elytra broader than the prothorax, dilated posteriorly, rugose, and distinctly costate. Till these ♀ forms can be obtained with their respective males from their special localities it is impossible to locate them correctly.

58. **Discodon serrigerum.** (Plate VIII, fig. 58, prothorax, ♂.)

Silis serrigera, Gorh., Biol. Centr.-Am., Coleopt. iii, 2, p. 292 (♂♀).
Silis varians, Gorh., loc. cit. p. 92 (part.).
Silis varians, var., Gorh., loc. cit. pl. 6, fig. 1 (♀).

♂. Eyes rather small; antennae long, flattened, broadly serrate, and lineate from the third joint, becoming rapidly narrower from the seventh onwards, 10 and 11 narrow and often flavous; prothorax about as long as broad, rather narrow, subcampanulate, obliquely compressed on each side of the disc anteriorly, the margins narrowly reflexed, and narrowly obliquely notched immediately in front of the laterally-projecting hind angles; elytra long, usually more or less dilated posteriorly; inner claw of anterior tarsi with an abrupt narrow dentiform lobe at the base, and outer claw of the other tarsi feebly cleft at tip.

♀. Eyes smaller; antennae with the intermediate joints still broader; prothorax a little broader at the base, the notch in front of the hind angles shallower and longer.

Hab. Mexico, Tuxtla [♀], Teapa [♂♀]; Guatemala, Panima in Alta Vera Paz (♂♀); Panama, Bugaba, Volcan de Chiriqui, Caldera [♂♀, types].

This species has the antennae and prothorax (except that the notch in front of the hind angles is shallower in ♀) very similarly formed in the two sexes, and the inner anterior tarsal claw of the male armed with an abruptly projecting dentiform lobe. The elytra are often wholly ochreous, except along the basal portion of the suture, but in some specimens the apical half and the suture thence to the base are black; the prothorax always has a black median vitta, extending forwards on to the head; and the femora are sometimes testaceous to near the apex. Gorham figured a pallid female from Panima as a variety of *S. varians*. His selected types of *D.* (*Silis*) *serrigerum* were from Chiriqui.

Section III.

59. Discodon lampyroides.

Telephorus (*Discodon*?) *lampyroides*, Gorh., Biol. Centr.-Am., Coleopt. iii, 2, p. 89, pl. 6, fig. 15 (♀).
Discodon lampyroides, Gorh., loc. cit. p. 288 (♂♀).
Telephorus picticollis, Gorh., loc. cit. pp. 79, 83, 84, 287 (sine descr.).

Elongate, broad, shining, finely pubescent; varying in colour from black, with the prothorax (an oblong patch on the disc excepted) and the abdomen in great part (the last ventral segment excepted) testaceous to almost entirely testaceous (a spot at the

base of the prothorax excepted), the elytra in the type fusco-bivittate on the disc and for the rest pale testaceous. Eyes moderately large. Antennae very long, slender, and sparsely pilose in both sexes. Prothorax transverse; the sides in ♂ subparallel, and with a narrow, deep, oblique notch at about the basal third, in ♀ broadly explanate, and sinuate or, at most, feebly rounded. Elytra very long, moderately explanate from a little below the shoulder. Inner claw of anterior and outer claw of intermediate tarsi broadly lobed, and outer claw of posterior tarsi deeply cleft, in ♂.

♂. Eighth ventral segment short, rapidly narrowed, arcuato-carinate down the middle at the apex, the apex itself rounded; internal sac, as seen evaginated, with a long, greatly developed, wing-like, acuminate process on each side, a pair of stout, laterally-projecting hooks at the base, and two long spines on each side of the central tube. (Fig. 22.)

Hab. Guatemala, Las Mercedes [♂] and Cerro Zunil, Pacific slope; Costa Rica; Panama, Chiriqui.

One male and eight females seen, the two from Chiriqui almost wholly testaceous, and one of those from Cerro Zunil with the legs and elytra black. The tarsal claws of the male are formed as in *D. normale*, *perplexum*, and *luridum*. This is one of the largest known species of *Discodon*. The genital armature of the male, as seen with the internal sac evaginated, is very remarkable.

60. **Discodon albolateris**, n. sp.

Cantharis albolateris, Sturm, in litt.
Discodon sp.? (No. 2a), Gorh., Biol. Centr.-Am., Coleopt. iii, 2, p. 285 (♀).

♀. Elongate, broad, opaque, finely pubescent; brownish-black, the anterior portion of the head and the prothorax (a broad median vitta excepted) pale flavous. Head broad; antennae rather slender, not reaching the middle of the elytra. Prothorax strongly transverse, wider than the base of the elytra, truncate at the apex (as seen from in front), explanate at the sides, the latter sinuate, rounded anteriorly, and gradually converging from near the base. Elytra extremely elongate, moderately explanate from a little below the shoulder.

Length (excl. head) 15½, breadth 6½ mm.

Hab. Mexico (*Sturm, ex coll. Sallé*).

Gorham having quoted Sturm's MS. name for this species, a description is appended, though a single female

specimen only is known. *D. albolateris* is as large as the same sex of *D. lampyroides*, from Guatemala, etc., but has a broader prothorax, which is narrowed from near the base, etc. It can be placed near the latter for the present.

61. Discodon normale.

Discodon normale, Gorh., Biol. Centr.-Am., Coleopt. iii, 2, pp. 82, 287, pl. 5, fig. 20 (♀).
Telephorus normalis, Gorh., loc. cit. pl. 6, fig. 20 (♂).
? *Discodon flavomarginatum*, Schaeff., Journ. N. York Ent. Soc. xvi, p. 65.

Black or piceous, the head on each side in front, and sometimes the epistoma also, the base of the mandibles, and the prothorax (a broad median vitta, or a triangular or cruciform patch on the disc, and sometimes a small spot on each side in ♂, excepted) flavous or rufo-testaceous. Antennae (♂) moderately long, rather stout, subserrate, tapering towards the tip, closely pilose; (♀) shorter, sparsely pilose. Eyes rather small in both sexes. Prothorax transverse, with a narrow, deep, straight incision on each side at about one-third from the base in ♂; wider in ♀, with the margins broadly explanate and feebly sinuate. Elytra at the base about as wide as the prothorax, in ♀ usually more or less explanate at the sides. Anterior tarsi dilated in ♂. Inner claw of anterior tarsi and outer claw of intermediate tarsi broadly lobed, and outer claw of posterior tarsi deeply cleft (the outer portion of the claw submembranous, and shorter and broader than the other), in ♂. Sixth ventral segment of ♂ very deeply, triangularly emarginate, the seventh long, and with the two lobes compressed and subangularly raised posteriorly, the median fissure becoming rather broadly open anteriorly, leaving a portion of the smooth, shining eighth segment exposed. (Fig. 23, profile view.)

Var. α. The sutural and outer margins of the elytra, and sometimes the apical third indeterminately, the margins and apex of the abdomen, and the femora and tibiae in some specimens, testaceous or flavous. ♂ ♀.

Discodon normale, var., Gorh., loc. cit. pp. 82, 287.
Discodon dubium, Gorh., loc. cit. p. 85 (part.).

Var. β. Prothorax, scutellum, and the anterior and intermediate femora, flavous or rufo-testaceous. ♀.

Discodon difficile, Gorh., loc. cit. p. 288 (*nec* p. 86) (specim., ♀, from Cuernavaca).

Var. γ. Elytra wholly testaceous, the black median vitta of the prothorax well developed. ♂ ♀.

♂. Eighth ventral segment long, raised and much narrowed towards the apex, and produced on each side of the medium notch into an oblique elongate-triangular plate (as seen in profile), which is somewhat hooked at the base above (lower portion of fig. 23); ninth segment long, narrowed towards the base and apex, the internal sac, as seen evaginated, armed with four pairs of long, curved hooks (the pair nearest the base longer and stouter than the others), the central tube very long and enclosing a slender, hooked flagellum (fig. 23*a*).

Hab. Mexico, Morelos, Jalisco, Vera Cruz, Guerrero, Oaxaca, Mexico City, etc.; Guatemala, Totonicapam, Capetillo.

One of the commonest species of the genus in Mexico, the form with wholly black elytra being more abundant than the variety with flavous suture and outer margin (= *dubium*, Gorh.). The var. β is represented by three females from Chilpancingo and one from Cuernavaca, and the var. γ by six specimens (♂ ♀), five of which are in the Hope collection at Oxford. Two species from Oaxaca were included by Gorham under *D. dubium*, his type and description applying to the var. α of *D. normale*. An interesting series connecting the various forms was obtained by Mr. H. H. Smith at Omilteme, in the mountains of Guerrero, females, as usual, predominating. The peculiar genital armature and the form of the intermediate tarsal claws of the male distinguish *D. normale* from most of its allies. The species is nearly related to *D. lampyroides*, Gorh. Eleven males have been dissected, showing considerable variation in the development of the produced, raised, apical portions of the eighth ventral segment. *D. flavomarginatum*, Schaeff., from the Huachuca Mts., Arizona, seems to be a form of *D. normale*.

62. Discodon perplexum.

Discodon perplexum, Gorh., Biol. Centr.-Am., Coleopt. iii, 2, p. 83 (♂) (*nec* p. 287).

♂. Broad, black, the sides of the head in front, the base of the mandibles, the prothorax (a rather narrow median vitta excepted), and the apical two segments or more of the abdomen, flavous or testaceous, the femora obscure testaceous. Antennae very long,

slender, subfiliform, closely pilose. Prothorax strongly transverse, with a narrow, deeply-cut, oblique notch on each side just before the base, the hind angles obtuse. Elytra long, at the base of the same width as the prothorax, broadly arcuato-explanate from a little below the shoulder. Sixth ventral segment deeply, triangularly emarginate; seventh segment long, the two lobes scarcely raised posteriorly, the median fissure somewhat open, leaving a portion of the eighth segment exposed. Inner claw of anterior tarsi and outer claw of middle tarsi broadly lobed; outer claw of posterior tarsi deeply cleft, the outer portion of the claw much shorter than the inner.

Var. ♀. Prothorax wholly testaceous, broadly explanate at the sides, arcuately narrowing forwards, the margins feebly sinuate.

Discodon difficile, Gorh., loc. cit. p. 288 (*nec* p. 86) (specim., ♀, from Yolos, Oaxaca).
Telephorus photurinus, Gorh., loc. cit. pl. 6, fig. 19 (♀).

♂. Eighth ventral segment simply cleft at the apex; ninth segment produced on each side into a long, dentiform process, two broader, compressed, abruptly-pointed hooks projecting from the internal sac and two spines visible between them (fig. 24, profile view).

Hab. Mexico, Misantla in Vera Cruz [♂], Yolos in Oaxaca [♀].

Redescribed from Gorham's types—two males. The females he subsequently referred to *D. perplexum* are colour-varieties of his *D. luridum*, but his *D. difficile*, ♀, from Yolos, which has slender antennae, almost certainly belongs here. Differs from *D. normale* in the broadly explanate, posteriorly attenuate elytra; the longer, slender, subfiliform antennae; the more oblique, juxta-basal incisure of the prothorax; and in the genital armature.

63. Discodon luridum.

Discodon luridum, Gorh., Biol. Centr.-Am., Coleopt. iii, 2, p. 85.

Broad, black or piceous, the sides of the head in front, the base of the mandibles, the prothorax (a broad median vitta or triangular patch excepted), and the apex and sides of the abdomen flavous, the elytra uniformly brownish-ochraceous. Antennae (♂) moderately long, rather stout, subserrate, tapering outwards, closely pilose; (♀) shorter, sparsely pilose. Prothorax with a narrow, deep,

straight incision on each side at about one-third from the base in ♂; wider in ♀, with the margins broadly explanate and at most feebly sinuate. Elytra broadly arcuato-explanate from a little below the shoulder. Tarsi and sixth and seventh ventral segments of ♂ as in *D. normale*.

Var. α. Elytra nigro-fuscous, with the margin broadly flavous. ♂.

Discodon perplexum, var. ?, Gorh., loc. cit. p. 287.

Var. β. Elytra with the margin and suture ochraceous, the disc fuscous. ♀.

Var. γ. Elytra wholly, and sometimes the abdomen also, nigro-fuscous or black. ♂ ♀.

Discodon perplexum, var. ?, Gorh., loc. cit. p. 287.

♂. Eighth ventral segment raised and bilobed at the tip (fig. 25*a*), the lobes (seen in profile) oblique and triangular at the apex, and armed with a sharp tooth above (lower portion of fig. 25); ninth segment broad, the apices of the hooks enclosed within the internal sac visible (fig. 25).

Hab. Mexico, Vera Cruz and Oaxaca.

The insect described by Gorham under the name *D. luridum* has been received in numbers from Juquila in Oaxaca, the var. α occurring at the same locality and at Playa Vicente in Vera Cruz; the var. γ has been found at Misantla in Vera Cruz, and there are three others (♂ ♀) in the Oxford Museum labelled "Mexico"; the var. β is represented by a single ♀ in the Oxford Museum. The variations in colour, therefore, correspond with those of *D. normale*, of which *D. luridum* is perhaps no more than a form with broadly explanate elytra, the genital armature of the male being very similar in the two insects. From *D. perplexum* the position of the prothoracic incision, the stouter and more tapering antennae, and the genital armature, sufficiently distinguish *D. luridum*, at least in the male sex.

64. **Discodon nigrifrons**, n. sp.

Telephorus nigrifrons, Chevr., in litt.

Elongate, rather robust, thickly clothed with long, coarse, cinereous pubescence; nigro-piceous or black, the head from between the eyes to the apex (the black basal portion produced into a dentiform projection in the middle anteriorly), the base of the antennae, the prothorax (a subcordate spot on the disc excepted in two speci-

mens), the sutural and outer margins of the elytra, the coxae, trochanters, femora, and tibiae, and the abdomen in part, testaceous or rufo-testaceous. Antennae long and slender. Eyes small. Prothorax (♂) transverse, somewhat rounded at the sides, the latter angularly notched at some distance behind the middle, the hind angles obtuse; (♀) broader, the sides rounded anteriorly and bisinuate between the middle and the base. Elytra long, wider than the prothorax, subparallel in ♂, slightly dilated from a little below the shoulder in ♀. Inner claw of anterior tarsi, and outer claw of the other tarsi, lobed in ♂, the lobe on the posterior pair dentiform. Sixth ventral segment very deeply triangularly emarginate, and the seventh raised on each side of the median fissure towards the apex, in ♂.

Length (excl. head) 9–10, breadth 3–4 mm. (♂ ♀.)

Hab. Mexico, Juquila in Oaxaca (*Sallé*).

One male and two females (one of the latter with the prothorax immaculate), left undetermined by Gorham. The form of the ♂ tarsal claws (except that the shorter portion of the outer posterior one is less acute) brings this species near *D. normale*, from all the varieties of which *D. nigrifrons* may be separated by the basally narrowed prothorax of the male, and the peculiarly marked head. The female is extremely like the same sex of certain varieties of *D. inconstans* and *D. rufipes*, but it has the prothorax differently shaped and the head otherwise coloured. The aedeagus has not been dissected, but the form of the cleft seventh ventral segment (♂) is very like that of *D. normale*.

Photinomorpha, n. gen.

Head short, vertical, completely invisible from above; antennae rather short, stout, serrate, joint 2 more than half the length of 3; prothorax semicircular, explanate laterally and anteriorly, without trace of marginal notch in either sex; elytra long, broadly dilated from a little below the humeri; seventh ventral segment divided down the middle in ♂; tarsi each with one claw broadly lobed at base in ♂, the penultimate joint a little longer than the third.

Type, *P. simulans*, n. sp.

The two species placed under the above generic name bear an extraordinary resemblance to various Lampyrids inhabiting the same region. They were at first included by me under *Polemius*, *P.* (*Discodon*) *serricornis* and *lugubris*, Gorh., being to some extent intermediate; but

in these latter the prothorax is more or less truncate in front (leaving a portion of the head exposed from above) and has a faint oblique notch towards the base, at least in ♂, and the second joint of the antennae is small. *P. dilaticornis*, of which the ♀ only is known, was placed doubtfully by Gorham as a variety of *P. serricornis*; it can be included under *Photinomorpha* for the present. *Photurocantharis*, Pic,* based upon four or five species from Tropical South America, has the prothorax similarly produced anteriorly; but it differs from the present genus in having the head subrostrate, and the penultimate tarsal joint so deeply cleft as to appear strongly and narrowly bilobed. These southern insects were supposed by Pic to belong to the Lampyrid-genus *Photuris* and were sent by him to Olivier as such for determination.

1. **Photinomorpha simulans**, n. sp. (Plate III, figs. 5, ♂; 6, ♀, var.)

Broad, opaque, finely pubescent; black, the prothorax (a large subtriangular or transverse patch on the disc excepted), the base of the mandibles, the explanate margins of the elytra, and the last ventral segment wholly in ♂ and at the sides in ♀, flavous. Antennae stout, serrate, gradually tapering towards the tip, short in ♀, longer in ♂, joint 2 stout, rather more than one-half the length of 3, 3 a little shorter than 4. Prothorax transverse, semicircular, broadly explanate laterally, the margins very feebly sinuate anteriorly and before the base, without trace of notch in ♂. Elytra elongate, at the base parallel and narrower than the prothorax, the margins broadly arcuato-explanate from a little below the humeri, the disc obsoletely costulate. ♂ ♀.

Var. The elytra and abdomen wholly, and sometimes the explanate portions of the prothorax also in part or almost entirely, black. ♀.

♂. Eighth ventral segment broad, short, carinate down the middle posteriorly, feebly emarginate and subcrenulate at the apex, the short dorsal portion of the same segment deeply cleft and armed at the apex on each side with two short, curved teeth; on either side of the partially evaginated internal sac a very long, stout hook is extruded, and the apices of several shorter hooks are also visible beyond the tip of the ninth segment. (Figs. 26, 26*a*.)

Length 13–16, breadth 6–7½ mm. (♂ ♀.)

* Mélanges exot.-entom., fasc. x, p. 3 (Oct. 1914).

Hab. Mexico, Omilteme in Guerrero 8000 feet (*H. H. Smith*).

Twelve specimens, all females but one, four (♂♀) belonging to the form selected as typical, and two of the others having the prothorax in great part or almost wholly black. The flavo-marginate form closely resembles *Photinus nigridorsis*, Gorh., from Oaxaca, except that the dilatation of the elytral margin starts from below, instead of at the shoulder; the dark form was sent with a similarly-coloured *Photinus* from the same locality.

2. **Photinomorpha dilaticornis,** n. sp. (Plate III, fig. 7, ♀.)

Discodon serricorne, var. ?, Gorh. Biol. Centr.-Am., Coleopt. iii, 2, p. 288 (♀).

♀. Broad, opaque, finely pubescent; black, the prothorax orange, with or without a dark patch on the disc, the mandibles rufescent. Head not visible from above, rather broad, the eyes not prominent; antennae short, stout, subserrate, gradually narrowed towards the tip, joint 2 stout, fully one-half the length of 3. Prothorax transverse, ample, semicircular, truncate at the base, broadly explanate at the sides, the hind angles prominent, obtuse. Elytra long, flattened and obsoletely costulate on the disc, at the base parallel and not wider than the prothorax, abruptly and broadly explanate from a little below the humeri.

Length 11¾–12½, breadth 5–5½ mm.

Hab. Mexico, Parada in Oaxaca (*Sallé*), Oaxaca (*Mus. Brit.*).

Two females, distinguishable from the same sex of *Polemius* (*Discodon*) *serricornis*, Gorh., by the wholly black head, the shorter and less tapering antennae, with larger and stouter second joint; and the broader prothorax, with more regularly rounded, strongly explanate margins, and rather prominent hind angles. The specimen in the British Museum was acquired in 1858.

Polemius.

Polemius, Leconte, Proc. Acad. Phil. v, p. 338 (1851), and Trans. Am. Ent. Soc. ix, p. 55 (1881); Lacordaire, Gen. Coleopt. iv, p. 359 (1857); Schaeffer, Journ. N. York Ent. Soc. xvi, p. 61 (1908).

Leconte referred three N. American species to this genus, *Cantharis laticornis*, Say (= *Telephorus dubius*,

Melsh.), being taken as the type, and others from Arizona have since been added by Fall and Schaeffer. Its essential characters, ♂, are the simply incised lateral margins of the prothorax (the notch sometimes wanting), the undivided tarsal claws, and the cleft seventh ventral segment. The type, like that of *Silis*, has stout, serrate antennae and small eyes. *Polemius laticornis* appears to have been unknown to Gorham, but there are males of it from Texas in the British Museum and others have been sent me by Mr. Fall. The genus as here understood includes various forms described under *Discodon* and *Silis* by Gorham; *P. basalis*, Waterh., from Borneo, must belong elsewhere. A Miocene species from Florissant (*P. crassicornis*) has recently been named by Wickham.

The Central American species may be grouped by their ♂ characters thus * :—

I. Prothorax with or without a shallow notch on each side near the base, semicircular, or with the margins feebly sinuate, more or less truncate in front, leaving a portion of the head exposed from above; antennae serrate; tarsi each with one claw broadly lobed at base: species Lampyriform . . . . . *Species* 1–5.

II. Prothorax with a conspicuous, rarely subobsolete, notch on each side, the margins usually more or less angulate, lamellate, or subdentate in front of the incision; anterior tarsi and sometimes the others also, with one of the claws lobed or dilated at base: species Lampyriform or Telephoriform.

a^1. Antennae stout, serrate . . . . . *Species* 6.

b^1. Antennae more slender, serrate in some of the species . . . . . *Species* 7–35.

Species of doubtful position, females only known . . . . . *Species* 36, 37.

1. Polemius serricornis.

Discodon serricorne, Gorh., Biol. Centr.-Am., Coleopt. iii, 2, p. 288, pl. 6, fig. 18 (♀) (excl. var.).

* Females only known of species 10 and 17.

Broad, opaque, black, the anterior portion of the head, the base of the mandibles, the prothorax (a patch on the disc excepted), and sometimes the outer limb of the elytra indeterminately, flavous or reddish-yellow. Head almost invisible from above, eyes somewhat prominent in ♂; antennae serrate, rapidly tapering towards the tip, short in ♀, longer in ♂, joints 3–6 considerably widened in both sexes. Prothorax strongly transverse, semicircular, truncate in front, broadly explanate in both sexes; the sides feebly obliquely notched near the base in ♂ and slightly sinuate in ♀. Elytra in ♂ narrower than, and in ♀ as broad as, the prothorax, broadly explanate from a little below the shoulder. Inner claw of anterior tarsi, and outer claw of the other tarsi, broadly lobed in ♂.

♂. Ninth ventral segment rather convex, narrowed towards the apex, the two spines projecting from the internal sac strongly hooked at the tip.

Hab. Mexico, Morelos, Oaxaca.

This species mimics *Photuris cyathigera*, Gorh., and other Lampyrids. One male and two females seen. It is distinguishable by the semicircular prothorax, which is feebly notched just before the base in the male, the flavous anterior portion of the head, the broadly explanate elytra, and the stout, serrate, rapidly tapering antennae. The two spines projecting a little beyond the tip of the ninth ventral segment correspond to those mentioned under *P. lugubris* as projecting at right angles from the evaginated internal sac, but they are more hooked at the apex. The variety (?) from Parada described by Gorham (loc. cit.) is referred to a different species, *Photinomorpha dilaticornis*.

2. Polemius lugubris.

Discodon lugubre, Gorh., Biol. Centr.-Am., Coleopt. iii, 2, p. 85.

Broad, opaque, black, the anterior portion of the head, the base of the mandibles, and the flanks of the prothorax yellow, the disc of the latter sometimes with two faint reddish marks. Eyes not prominent. Antennae subserrate, stout, rapidly tapering towards the tip, short in ♀, longer in ♂, joint 2 small. Prothorax large, strongly transverse, rugulose, broadly explanate in both sexes; the sides rounded anteriorly, deeply, obliquely notched a little before the base in ♂, and slightly sinuate in ♀. Elytra about as wide as the prothorax at the base, broadly explanate from a little below the shoulder. Inner claw of anterior tarsi, and outer claw of the other tarsi, broadly lobed in ♂.

Var.? Head wholly black; prothorax smoother and more abruptly explanate; elytra distinctly costate. ♀.

♂. Eighth ventral segment cleft and bilobed at the tip; ninth segment polished, rather convex, narrowed towards the apex, the internal sac (as seen evaginated) armed with several small and four long spines—one projecting at right angles on each side, stout, hooked at the tip, one on the ventral aspect directed vertically, cleft at the apex, and another on the dorsal aspect, pointed at the tip.

Hab. Mexico, Morelos and Durango.

There are four specimens of this species in the "Biologia" collection, one of which (♀), from Las Peras in Oaxaca, with the head wholly black, may belong to a different species. The spines projecting from the evaginated internal sac of the aedeagus are long and stout, and another pair of stout spines are visible beneath the eighth ventral segment after the ninth segment has been extracted, corresponding to the long hooks present in *Photinomorpha simulans*. Gorham describes the outer hind tarsal claw of the male as "vix fissis," whereas it has a rounded lobe similar to that on the corresponding claw of the intermediate and anterior tarsi.

3. **Polemius integer,** n. sp.

Moderately elongate, rather broad, dull, finely pubescent; black, the sides of the head in front, the base of the mandibles, and the sides of the prothorax broadly (leaving a broad, black, posteriorly dilated vitta or triangular patch), yellow. Antennae (♂) moderately long, subserrate, tapering outwards, with joint 3 shorter than 4; (♀) much stouter and shorter, with joints 3 and 4 equal in length. Eyes rather small in both sexes. Prothorax (♂) strongly transverse, subtruncate in front, gradually narrowing from the base, the margins broadly explanate, entire, plicate at about the basal fourth above; (♀) wider and with the sides more rounded. Elytra moderately long, about as wide at the base as the prothorax, more or less explanate from a little below the shoulder, feebly costulate on the disc. Inner claw of anterior tarsi, and outer claw of the other tarsi, broadly lobed in ♂.

♂. Eighth ventral segment long, acuminate, carinate down the middle, feebly cleft at the tip; ninth segment oblong, rounded at the apex, a stout, feebly curved, flattened tube partly extruded (fig. 27, dorsal aspect).

Length (excl. head) 8–10½, breadth 3⅛–5 mm. (♂ ♀.)

Hab. Mexico, Omilteme and Xucumanatlan in Guerrero (*H. H. Smith*: ♂♀), Oaxaca (*Sallé*: ♂).

Described from one male and six females from Guerrero. The two males from Oaxaca, left unnamed by Gorham, are smaller and narrower, and have more slender antennae; but there can be little doubt that they belong to the same species, the genital armature being similar. A Lampyriform insect, with the lateral margins of the prothorax entire in the male.

4. **Polemius nigrolimbatus,** n. sp.

Discodon cleroides, var., Gorh., Biol. Centr.-Am., Coleopt. iii, 2, p. 287 (♂).

Rather broad, dull, clothed with fine brownish or cinereous pubescence; black, the base of the mandibles, and a rather broad, anteriorly widened, oblique, submarginal stripe on each side of the prothorax (the two stripes usually connected along the apical margin) flavous. Eyes not prominent. Antennae subserrate, rather stout, tapering towards the tip, short in ♀, longer in ♂. Prothorax ample, as broad as or broader than the base of the elytra, subtruncate in front, broadly explanate laterally; the sides gradually, arcuately converging forwards from near the base, at most very feebly sinuate, without trace of notch in ♂. Elytra more or less explanate from a short distance below the base, coriaceous, obsoletely costulate. Inner claw of anterior and outer claw of the other tarsi lobed in ♂.

♂. Ninth ventral segment oblong, gradually narrowed towards the apex, the extruded flagellum acuminate and simply curved. (Fig. 28).

Length (excl. head) 7½–10, breadth 3–4½ mm. (♂♀.)

Hab. Mexico (*Truqui*, *Sallé*; *Mus. Oxon.*), Mexico City (*Höge*, *H. H. Smith*), Toluca (*Sallé*).

Apparently not rare in the vicinity of the city of Mexico, whence six examples have been received. This species and *P. nigromarginatus* differ from *Discodon cleroides* in having the prothorax unnotched and somewhat rounded at the sides in the male, and the tarsal claws otherwise formed in that sex, the head black to the anterior margin, and the prothorax relatively very broad in both sexes. The less rounded sides of the prothorax and the broader yellow submarginal stripes separate *P. nigrolimbatus* from *P. nigromarginatus*.

5. **Polemius nigromarginatus,** n. sp. (Plate III, fig. 8, ♂.)

Discodon cleroides, Gorh., Biol. Centr.-Am., Coleopt. iii, 2, p. 287 (♀) (*nec* p. 84) (excl. var.).

Rather broad, dull, clothed with fine blackish pubescence; deep black, with the base of the mandibles, and a sharply defined sinuate submarginal stripe on each side of the prothorax (leaving a very large triangular patch on the disc and the outer margins black), pale flavous. Eyes somewhat prominent in ♂. Antennae subserrate and tapering towards the tip in ♀, a little longer and with joints 3–7 less widened in ♂. Prothorax broad, transverse, widely explanate laterally, the margins somewhat rounded, feebly sinuate, and without trace of notch in ♂, the hind angles obtuse. Elytra a little wider than the prothorax, very feebly explanate in ♀, coriaceous, subcostulate. Inner claw of anterior and outer claw of the other tarsi broadly lobed in ♂.

♂. Eighth ventral segment broad, sharply carinate down the middle posteriorly; ninth segment rather broad, parallel-sided, abruptly, obliquely narrowed towards the apex, the extruded flagellum bent and sharply acuminate (fig. 29).

Length (excl. head) $6\frac{1}{4}$–9, breadth $2\frac{1}{4}$–$3\frac{1}{2}$ mm.

Hab. Mexico, Ciudad in Durango, 8100 ft. (*Forrer*: ♀; *Höge*: ♂ ♀).

The three females from Durango referred by Gorham in his "Supplement" to *Discodon cleroides* belong to the present species, of which a long series was subsequently received from Höge from the same locality. The females of the two insects, it is true, are very similar, that of the present species being recognisable by the wholly black head, the rounded sides of the prothorax, and the less dilated margins of the elytra. The males have a very differently shaped prothorax, and the tarsal claws otherwise formed.

6. **Polemius spissicornis,** n. sp. (Plate VIII, fig. 59, prothorax, ♂.)

Moderately elongate, rather broad, dull, finely pubescent; black, the base of the mandibles and the prothorax (a broad patch on the disc excepted) testaceous or flavo-testaceous. Head short; antennae serrate, stout, about reaching the basal third of the elytra, slightly tapering towards the tip. Prothorax (♂) very short, broad, sulcate down the middle posteriorly, the lateral margins reflexed, and narrowly, deeply, obliquely excised towards the base, appearing

dentate in front of the excision, and arcuately converging thence to the apex, the hind angles acute; (♀) broader, more rounded at the sides, the latter bisinuate towards the base. Elytra moderately long, much wider than the prothorax, somewhat dilated at the sides in ♀, costulate and rugosely sculptured. Inner claw of anterior tarsi, and outer claw of the other tarsi, lobed at base.

Length (excl. head) $5\frac{1}{3}$–7, breadth 2–$2\frac{4}{5}$ mm. (♂ ♀.)

Hab. Mexico (*Truqui, in Mus. Brit.; Coffin, in Mus. Oxon.*).

Two pairs. This insect is very like the N.-American *Polemius laticornis* (Say), but has shorter and stouter antennae, a shorter and more equally dilated prothorax, and the margins of the latter deeply obliquely excised near the base in the male, much as in *P.* (*Discodon*) *lugubris*, Gorh. *P. spissicornis* has the facies of a small Lampyrid. The antennae scarcely differ in form in the two sexes.

7. Polemius difficilis.

Discodon difficile, Gorh., Biol. Centr.-Am., Coleopt. iii, 2, p. 86 (*nec* p. 288, and fig. of *T. photurinus*, pl. 6, fig. 19, ♀) (Guanajuato examples only, ♂ ♀).

Polemius difficilis, Schaeff., Journ. N. York Ent. Soc. xvi, p. 61.

Comparatively short and broad, dull, finely pubescent; black, the anterior portion of the head, base of mandibles, basal joint of antennae externally, and prothorax flavous or testaceous. Head broad; eyes moderately large and prominent in ♂, smaller in ♀. Antennae rather short, comparatively stout, subserrate, tapering outwards. Prothorax very broad in both sexes, subtruncate at the apex (as seen from in front), rounded at the sides anteriorly; the margins narrowly notched towards the base in ♂, and abruptly emarginate at the same place in ♀. Elytra rather short, of the same width as the prothorax at the base, blunt at the tip, somewhat or moderately explanate at the sides from a little below the humeri, the sculpture rather coarse. Inner claw of anterior tarsi, and outer claw of other tarsi, broadly lobed in ♂.

Var. α. Prothorax with a black anteriorly dilated median vitta. ♂ ♀.

Discodon triste, Gorh., loc. cit. p. 287 (part.) (Ventanas specimens, ♀).

Var. β. Anterior half of head, basal joint of antennae, scutellum,

sutural and outer margins of elytra narrowly, coxae, trochanters, and femora in part or entirely, and base of tibiae, flavous or testaceous. ♀.

♂. Eighth ventral segment long, oval, carinate down the middle, rounded, cleft and upturned at the tip; ninth segment narrow, two pairs of stout spines projecting from the internal sac. (Fig. 30.)

Length (excl. head) 7½–9½, breadth 3–4½ mm. (♂ ♀.)

Hab. Mexico (*Truqui*), Ventanas in Durango (*Forrer*), Durango City, Iguala and Chilpancingo in Guerrero (*Höge*), Jalisco (*coll. Fry*: ♂ ♀), Guanajuato (*Sallé*: types, ♂ ♀).

Redescribed from the types (a pair from Guanajuato), a similar pair from Jalisco in Fry's collection, and a female from Durango City; the other specimens (♀) referred to it by Gorham, one of which was figured by him under the name *Telephorus photurinus* and quoted under *Discodon difficile* (p. 288), belong elsewhere. The var. *α* is represented by six examples (from Ventanas and Chilpancingo), and the var. *β* by a single female from Iguala. A comparatively short form, with the prothorax broad and very similarly shaped in the two sexes, the elytra more or less explanate at the sides. The var. *α* may have to be separated when more males are available for examination. The uncleft ♂ tarsal claws separate this and the next two species from *Discodon*.

8. Polemius photinoides.

Discodon photinoides, Gorh., Biol. Centr.-Am., Coleopt. iii, 2, p. 84 (*nec* p. 288).
Telephorus photinoides, Gorh., loc. cit. pl. 5, fig. 19 (♀).

Rather narrow (♂), broader (♀), moderately shining, clothed with fine brownish pubescence; nigro-fuscous or black, the anterior portion of the head, the base of the mandibles, the prothorax (a triangular patch on the disc excepted), and the sutural and outer margins of the elytra flavous, and the humeri and knees often testaceous. Eyes large in ♂. Antennae rather stout, serrate, tapering outwards, long in ♂, shorter in ♀. Prothorax strongly transverse; subquadrate and with a deep, narrow, oblique notch on each side towards the base in ♂, broader and with the more rounded sides deeply sinuate at about the basal third in ♀. Elytra moderately elongate, as wide as or wider than the prothorax at the base, gradually explanate at the sides from a little below the shoulder. Inner claw of anterior tarsi broadly, and outer claw of

the other tarsi feebly, lobed in ♂. Anterior tarsi rather broad in both sexes.

♂. Eighth ventral segment oblong, rounded and notched in the middle at the tip, carinate; ninth segment produced at the apex, an extremely elongate, slender flagellum and a stout curved hook projecting from the internal sac (fig. 31).

Hab. GUATEMALA (*Mus. Brit.*), San Gerónimo, Dueñas, Capetillo, Quiché Mts.

The specimens seen of this species, including a pair still "in copula" from San Gerónimo and two females acquired by the British Museum in 1855, are all from Guatemala, those from Chiriqui added by Gorham in his "Supplement" belonging to species with the tarsal claws of the males differently formed, etc. The two males dissected have the genital armature very different from that of *Discodon chiriquense* and the other species confused by Gorham under *P. photinoides*.

9. **Polemius flaccidus.**

Discodon flaccidum, Gorh., Biol. Centr.-Am., Coleopt. iii, 2, p. 88; Pic, Mélanges exot.-entom., fasc. ii, p. 14 (1912).

Elongate, narrow, moderately shining, finely pubescent; piceous, the sides of the head in front, the base of the mandibles, the basal joint of the antennae externally, the prothorax (a spot on the disc or an anteriorly evanescent median vitta excepted), the sutural and outer margins of the elytra, and the legs in great part, stramineous or testaceous. Eyes very large and prominent in ♂, small in ♀. Antennae moderately long, rather slender, shorter in ♀. Prothorax (♂) subquadrate, the margins with a narrow, deep, transverse notch at about the middle, the hind angles sharp; (♀) broader and more transverse, narrowing from near the base, constricted at the middle (the margins thus appearing strongly sinuate), the hind angles obtuse. Elytra long, subparallel, broader than the prothorax in ♀ and of about the same width in ♂. Inner claw of anterior tarsi somewhat broadly, and outer claw of the other tarsi feebly, lobed in ♂.

♂. Eighth ventral segment narrowing outwards, emarginate in the middle at the apex, the tip of the flagellum exposed.

Hab. GUATEMALA, Alta Vera Paz.

Gorham was in some doubt as to the identification of the sexes of this species. It has been redescribed from two

males and three females. The prothorax of the female is widened posteriorly, and in the male the lateral notch is sharply cut; the eyes, too, in the last-mentioned sex are much enlarged.

10. **Polemius fleximargo**, n. sp. (Plate III, fig. 9, ♀.)

♀. Elongate, dull, finely pubescent; nigro-fuscous, the sides of the head in front, the base of the mandibles, the prothorax (an elongate-triangular patch on the disc excepted), and the humeri and outer margins of the elytra flavous, the legs fusco-testaceous with the tarsi blackish. Antennae moderately long, subserrate, rather stout, slightly tapering towards the tip. Prothorax transverse, arcuate in front; the sides rounded posteriorly and rapidly, sinuously converging thence to the apex, the abruptly explanate margin becoming much narrower anteriorly. Elytra long, not wider than the prothorax at the base, distinctly costulate on the disc and arcuato-explanate at the sides just below the humeri, the dilated margin rapidly narrowed thence to the apex, the basal portion of the epipleura broad and somewhat thickened.

Length (excl. head) 7–8½, breadth 2¼–3 mm.

Hab. Panama, Volcan de Chiriqui (*Champion*).

Two females, left unnamed by Gorham. This species has the prothorax shaped as in the corresponding sex of *P.* (*Discodon*) *flaccidus*, Gorh., differing from it in the sinuato-explanate elytral margin and the anteriorly widened epipleura. *P. fleximargo* can be placed near *P. photinoides* and *P. flaccidus* for the present, these latter having one of the claws of each tarsus simply lobed at the base in the male.

11. **Polemius tristiculus**, n. sp.

Discodon triste, var., Gorh., Biol. Centr.-Am., Coleopt. iii, 2, p. 82.

Narrow, black, the mandibles testaceous, the sides of the prothorax (leaving a large cruciform black patch on the disc) yellow or reddish-yellow; clothed with rather long blackish pubescence. Antennae comparatively short and stout, serrate, slightly tapering towards the tip. Prothorax transverse, in ♂ subquadrate and with a narrow transverse notch on each side at about one-fourth from the base, in ♀ with the sides more rounded and deeply sinuate behind the middle. Elytra a little wider than the prothorax at the base,

subparallel or very feebly dilated at the sides. Inner claw of anterior tarsi, and outer claw of the other tarsi, broadly lobed in ♂.

♂. Ninth ventral segment oblong; the partially evaginated internal sac disclosing the tips of several pairs of spines and that of a central flagellum, and dilated into a sharp tooth on each side at the base. (Figs. 32, 32*a*.)

Length (excl. head) $6\frac{1}{2}$–7, breadth 2–$2\frac{3}{4}$ mm. (♂ ♀.)

Hab. GUATEMALA (*Mus. Brit.*), Quiché Mts. and the slopes of the mountains above Dueñas (*Champion*).

Six males and one female. Very like *Discodon melancholicum* (= *triste*), and with a similar large cruciform black patch on the disc of the prothorax, but differing from that species in the shorter and stouter antennae in both sexes; the male with one claw of each tarsus broadly lobed at the base, and the narrow lateral notch of the prothorax placed nearer the hind angle; the female with the sides of the prothorax deeply sinuate behind the middle. *D. nigropilosum* is also very like the present species, but it has a differently-shaped prothorax, cleft ♂ tarsal claws, etc. Two males of *P. tristiculus* have been dissected, one having the genital armature partly exposed.

12. **Polemius lineatocollis**, n. sp.

Moderately elongate, black, the base of the mandibles, and the sides of the prothorax broadly (leaving a sharply-defined broad black median vitta), yellow or reddish-yellow; clothed with fine greyish-brown pubescence. Antennae rather stout, serrate, moderately long, slightly tapering towards the tip, sparsely pubescent in both sexes. Prothorax transverse, subquadrate; in ♂ with an oblique notch on each side just behind the middle, in ♀ with the sides distinctly sinuato-emarginate at the middle. Elytra slightly wider than the prothorax at the base, moderately long, not or very feebly (♀) explanate at the sides. Inner claw of anterior tarsi broadly, and outer claw of the other tarsi more feebly, lobed in ♂.

♂. Eighth ventral segment feebly cleft, and the ninth rounded, at the tip, a very elongate, extremely slender, straight flagellum projecting from the internal sac.

Length (excl. head) $5\frac{5}{8}$–7, breadth 2–$2\frac{3}{4}$ mm. (♂ ♀.)

Hab. MEXICO (*Truqui*), Amula, Xucumanatlan, Chilpancingo, and Tepetlapa in Guerrero (*H. H. Smith*), Acapulco (*Höge*), Oaxaca (*Mus. Brit., Sallé*), Etla (*Sallé*).

Sent in plenty from various places in Guerrero and

sparingly from Oaxaca. Extremely like *Discodon melancholicum* (= *triste*), but with the outer claw of the intermediate and posterior tarsi of the male lobed at the base (instead of cleft), the median vitta of the prothorax not dilated into a cruciform patch, the margins usually distinctly sinuate in the female, the antennae of the male shorter, and sparsely pubescent as in the female. Three males dissected, one only showing the slender flagellum.

13. **Polemius bivittatus.** (Plate III, fig. 10, ♀, var. *β*.)

Discodon bivittatum, Gorh., Biol. Centr.-Am., Coleopt. iii, 2, p. 87.

Polemius bivittatus, Schaeff., Journ. N. York Ent. Soc. xvi, p. 61.

Elongate, dull (shining, when immature), finely pubescent; nigro-piceous or fuscous, the anterior portion at least of the head, the basal joint of the antennae in some specimens, the prothorax (two black sinuous vittae or spots on the disc excepted) and scutellum, the suture and outer margin of the elytra, the coxae, trochanters, and femora in some examples, and the abdomen in part or entirely, testaceous. Eyes rather small, a little larger in ♂. Antennae very long, slender and subfiliform in ♀, still longer, subserrate, and closely pilose in ♂. Prothorax (♂) transverse, arcuate in front, binodose on the disc posteriorly, the margins explanate and reflexed, at most feebly notched or sinuate at about the middle; (♀) broader, subtruncate at the apex, the margins more or less rounded. Elytra subparallel, wider than the prothorax, rather finely sculptured. Inner claw of anterior tarsi, and outer claw of the other tarsi, broadly lobed at base in ♂.

Var. *α*. Prothoracic vittae united into a large, laterally emarginate black patch; legs black. ♀.

Var. *β*. Elytra flavous, with the sutural and outer margins, and a narrow oblique stripe extending down the disc from the shoulder to very near the apex, black; femora testaceous. ♀. (Fig. 10.)

Var. *γ*. Elytra and femora testaceous. ♂.

♂. Eighth ventral segment shortly trilobed at the apex; ninth segment rather short, oval, subtruncate, the tips of two pairs of stout hooks and that of a central flagellum visible (fig. 33).

Length (excl. head) 8–12½, breadth 2¾–5 mm. (♂ ♀.)

Hab. Mexico, Vera Cruz, Guerrero (Chilpancingo and Omilteme), Oaxaca; Guatemala, Quiché Mts., Calderas (*Champion*), Capetillo (*Rodriguez*).

This insect varies in colour according to the amount of development of the flavous or black portions of the surface, some examples having the sterna, abdomen, antennae, and legs almost entirely pale. Immature specimens, too, are more shining than the others. The var. *a* was included by Gorham under *Discodon normale*. The other forms have all been found at Chilpancingo or Omilteme. The prothoracic notch is sometimes wanting in the males. *P. bivittatus* is mainly recognisable by the bivittate prothorax and the uncleft ♂ tarsal claws. A long series from Guerrero and Oaxaca has been examined. Two males dissected.

14. **Polemius fuscovittatus,** n. sp.

Discodon marginatum, Gorh., Biol. Centr.-Am., Coleopt. iii 2, p. 286 (*nec* p. 80).

Moderately elongate, shining, finely pubescent; testaceous, the eyes, the basal half of the head, and the abdomen in part infuscate or black in some examples, the prothorax rarely with a small transverse dark mark on the disc, the elytra each with a broad fuscous vitta of variable length on the disc, sometimes interrupted or constricted below the base and always reaching to near the apex. Eyes large and prominent in ♂, smaller in ♀. Antennae long and slender. Prothorax (♂) narrow, broader than long, binodose on the disc behind, the margins narrowly reflexed and notched at about one-third from the base, the hind angles obtuse; (♀) broader, narrowing from the basal third, the margins bisinuate. Elytra wider than the prothorax, subparallel. Inner claw of anterior tarsi, and outer claw of the other tarsi, angularly dilated at base.

♂. Eighth ventral segment broad, the short dorsal portions of the same segment hooked at the tip; ninth segment oblong; two curved spines visible within the internal sac, and two long, stout truncated hooks projecting from beneath them. (Figs. 34, 34*a*.)

Length (excl. head) 7–7¾, breadth 2¼–3 mm. (♂ ♀.)

Hab. Mexico. Playa Vicente and Jalapa in Vera Cruz.

Four males and two females. Less elongate and more shining than the Guatemalan *Discodon marginatum*, Gorh., the prothorax of the male not hollowed at the sides behind the middle, and with a definite notch, the tarsal claws not cleft in this sex, the genital armature different.

15. **Polemius maculifrons,** n. sp.

Moderately elongate, shining, finely pubescent; rufo-testaceous, the eyes, a spot on the vertex, the antennae (the basal joint excepted), an interrupted transverse streak on the disc of the prothorax towards the apex in ♂, the base and the apical half of the elytra (the sutural and outer margins excepted) indeterminately in ♂, or their entire surface (the margins excepted) in ♀, the tarsi in part or entirely and sometimes the knees also, and the under surface in part, fuscous or black. Eyes small. Antennae long and slender. Prothorax (♂) transverse, binodose on the disc towards the base, the sides strongly reflexed, somewhat rounded, and angularly notched at about the basal fourth, the hind angles obliterated; (♀) broader and more transverse, narrowing from near the base, the margins sinuate at the middle and before the obtuse hind angles, the space between the callosities sharply carinate in one specimen. Elytra long, much wider than the prothorax, subparallel, finely punctate and distinctly costulate. Inner claw of anterior tarsi, and outer claw of the other tarsi, lobed at base in ♂.

Length (excl. head) 7–8½, breadth 2½–3½ mm. (♂ ♀.)

Hab. Mexico, Real del Monte [♂ type] and Zacualtipan [♀], both in Hidalgo (*Höge*).

One male and two females, the latter having the elytra entirely (the sutural and outer margins excepted) black. Near *P.* (*Discodon*) *bivittatus*, Gorh., but with the lateral notch of the prothorax of the male placed nearer the base and the hind angles obliterated; the prothorax in the female narrowed from near the base and with the margins more sinuate, in this respect approaching the same sex of *Discodon erosum*, Gorh. The sexes of *P. maculifrons* are so dissimilar that they might be mistaken for different species. The elytral sculpture is fine, as in *P. bivittatus*.

16. **Polemius breviusculus,** n. sp.

Comparatively short and broad, finely cinereo-pubescent, shining; black, the anterior portion of the head, the prothorax (except two oval spots on the disc, which are confluent in ♂), the scutellum, coxae, and trochanters, the femora to near the tip, base of the tibiae, and the abdomen in part, rufo-testaceous. Head broad; eyes small; antennae slender, moderately long. Prothorax (♂) strongly transverse, rounded at the sides, the latter strongly reflexed and with a deeply-cut angular notch at the middle, the hind angles

obliterated; (♀) broader, the sides sinuate just beyond the middle. Elytra broader than the prothorax, comparatively short, subparallel in ♂, slightly explanate from a little below the shoulder in ♀, roughly punctate. Inner claw of anterior tarsi and outer claw of intermediate tarsi with an angular lobe at base in ♂.

♂. Ventral segment 6 feebly emarginate in the middle behind, 7 cleft and comparatively short, 9 short, broadly produced in the centre at the apex, a stout hook visible on either side of it.

Length (excl. head) 6–7½, breadth 2$\frac{1}{10}$–3 mm. (♂ ♀.)

Hab. Mexico, Ciudad in Durango (*Höge*).

One pair. A comparatively short, broad form, with the prothorax rounded at the sides behind, the lateral notch in the male deep, the outer posterior tarsal claw almost simple in this sex. In the unique male (after the genitalia have been extracted) an extremely long, slender, curved rod is visible in the fissure of the seventh ventral segment, arising from beneath the apical margin of the sixth, its apex being a little thickened and set with several setae. The prothorax of the ♂ is notched as in *P. binotatus*, Fall, but it is more transverse, and more rounded at the sides posteriorly.

17. **Polemius bimaculatus,** n. sp.

♀. Comparatively short and broad, shining, cinereo-pubescent; black, the anterior portion of the head, joints 1–3 of the antennae and the base of each of the following joints, the prothorax (two oblong streaks on the disc excepted) and scutellum, the sutural and outer margins of the elytra, the coxae and trochanters, the anterior femora and tibiae, and the bases or more of the other femora and tibiae, and the abdomen in part, flavous or testaceous. Head broad; eyes small; antennae rather short, slender. Prothorax strongly transverse, the sides scarcely reflexed, rounded anteriorly, and constricted just before the base, the hind angles obtuse. Elytra comparatively short, a little wider than the prothorax, feebly widened from below the shoulders, roughly punctate. Legs rather stout.

Length (excl. head) 6–6½, breadth 2$\frac{1}{5}$–2½ mm.

Hab. Mexico, Chilpancingo in Guerrero (*H. H. Smith*: type), Ventanas in Durango (*Höge*).

Two females, the one from Durango somewhat immature and with the antennae entirely testaceous. This species comes near *P. breviusculus*, but the shape of the prothorax (♀) is so different in the two forms that it is impossible to

treat *P. bimaculatus* as a colour variety of the former. *P. binotatus*, Fall, from the Chiricahua Mts., S. Arizona, a male of which has been sent me by its describer, is an allied form with wholly black, less rugose, more shining elytra, uniformly testaceous femora, etc. *P. arizonensis*, Schaeff., has the antennal joints 3–5 shorter and wider than in *P. binotatus*, the prothorax immaculate, etc.

18. **Polemius megalophthalmus,** n. sp. (Plate III, fig. 11, ♂.)

Elongate, narrow, shining, cinereo-pubescent; black or piceous, the base of the mandibles, the anterior portion of the head wholly (♂) or at the sides (♀), the prothorax and scutellum, the abdomen in part, and the base of the femora in ♂, testaceous. Head together with the eyes very much broader than the prothorax in ♂, of about the same width in ♀, the eyes enormously developed in ♂, small in ♀; antennae serrate, in ♂ longer than the entire body, in ♀ very much shorter. Prothorax (♂) almost smooth, nearly as long as broad, narrow, arcuate in front, the margins narrowly reflexed, and obliquely compressed and feebly incised at about the basal third, the hind angles subrectangular; (♀) transverse, less rounded in front, the margins shallowly notched at the basal third. Elytra long, parallel, wider than the prothorax, rugosely sculptured and feebly costulate. Inner claw of anterior tarsi, and outer claw of the other tarsi, lobed at base in ♂.

♂. Ninth ventral segment truncated at the apex, the corresponding dorsal portion of the same segment narrower and also truncate; two pairs of long, stout hooks projecting from the internal sac. (Fig. 35.)

Length (excl. head) 6–7, breadth 2–2½ mm. (♂ ♀.)

Hab. Mexico, Ventanas in Durango (*Höge*).

Five males and four females. This species is not unlike one of the varieties of *Discodon inconstans*, except that it is smaller and very much narrower. The male has enormously developed eyes and greatly elongated, serrate antennae, characters separating *P. megalophthalmus* from most of its allies. The prothorax is shining, almost smooth, and without definite callosities on the disc towards the base. The apically undivided, simply lobed tarsal claws of the male distinguish the present species from *Discodon incisum* and others; and the non-callose prothorax, larger eyes in ♂, etc., from *P.* (*Silis*) *longicornis*, Gorh.

19. **Polemius cephalotes.** (Plate VIII, fig. 60, prothorax, ♂.)

Telephorus (*Silis*) *cephalotes*, Gorh., Biol. Centr.-Am., Coleopt. iii, 2, p. 289 (♂ ♀).

♂. Head large, broad; eyes large; antennae very long, feebly subserrate, tapering towards the tip; prothorax fully as long as broad, narrow, the margins reflexed, obliquely plicate, deeply angularly notched just behind the middle (appearing bluntly dentate in front of this), and slightly hollowed before the hind angles; elytra much broader than the prothorax, widening to the apex; inner claw of anterior tarsi, and outer claw of the other tarsi, angularly dilated at base.

♀. Head, eyes, mandibles, and antennae much as in ♂, the eyes a little less prominent; prothorax transverse, the margins trisinuate, and thickened into a small blunt tooth at the middle, the hind angles acute and prominent.

Hab. Panama, Bugaba.

One male and two females seen. A moderately elongate, posteriorly widened form; shining, piceous, with the head (except on the middle of the vertex), the last two joints of the antennae, the sides of the prothorax, the humeri, and sometimes the base of the femora also, testaceous or yellow, the elytra finely sculptured, the head large in both sexes, the prothorax elongate and with the sides deeply angularly notched at about the middle in the male, the legs slender. *P. cephalotes* bears some resemblance to *Discodon plicatum*, Gorh., but the latter has two of the tarsal claws cleft in the male.

20. **Polemius sallaei.**

Silis sallaei, Gorh., Biol. Centr.-Am., Coleopt. iii, 2, p. 303.

♂. Eyes large; antennae elongate, slender; prothorax nearly as long as broad, obliquely grooved on each side anteriorly, the margins narrowly reflexed, angularly dilated at about the middle and subparallel thence to the acute hind angles; inner claw of anterior tarsi, and outer claw of the other tarsi, angularly dilated at base.

♀. Eyes smaller; antennae a little shorter; prothorax more transverse, more narrowed anteriorly, the margins simply trisinuate.

Hab. Mexico, Cordova (*Sallé*: ♂ ♀); Guatemala, Senahu in Alta Vera Paz (*Champion*: ♀).

Described by Gorham from two pairs from Cordova. A female from Vera Paz found placed under *P.* (*Discodon*) *bivittatus*, with the prothoracic vittae more strongly sinuate, seems to belong here. *P. sallaei* has the front of the head, a spot on the vertex, the prothorax (a sharply-defined, sinuous submarginal stripe on each side excepted), and the femora to near the tip, pale testaceous, and the rest of the body piceous.

21. **Polemius albibucca.**

Silis albibucca, Pic, Le Nat. 1910, p. 44 (♂ ♀).

Moderately elongate, shining, finely pubescent; nigro-piceous or piceous, the head in front, the prothorax, and the femora to near the tip, testaceous or pale testaceous. Head together with the eyes broader than the prothorax in ♂; eyes large in ♂, smaller in ♀; antennae long, slender, and sparsely pilose in ♂, shorter in ♀. Prothorax (♂) broader than long, obliquely bicallose on the disc, and with a short carina in the middle before the base, the margins broadly, subangularly dilated anteriorly and parallel thence to the acute hind angles; (♀) more transverse, the margins more broadly reflexed and simply trisinuate. Elytra much wider than the prothorax, subparallel, moderately long, roughly sculptured and obsoletely costate. Inner claw of anterior tarsi, and outer claw of the other tarsi, angularly dilated at base in ♂.

Length (excl. head) 4½–5½, breadth 1½–2 mm. (♂ ♀.)

Hab. Mexico (*Mus. Brit.*: ♀), Teapa (*H. H. Smith*: ♂♀).

Two males and three females, agreeing nearly with Pic's description, except in the paler colour of the prothorax, possibly due to immaturity. This species is very closely related to *P.* (*Silis*) *sallaei*, Gorh., of which it would appear at first sight to be a form with an immaculate prothorax, differing from it in the broader and more prominent tooth-like dilatation of the latter in the male, and in the more transverse prothorax of the female. Pic says his *Silis albibucca* is probably near *S. haematodes*, Gorh., the lateral prothoracic prominence of which is very differently shaped and placed behind, instead of at about, the middle in ♂. The two examples in the British Museum were acquired in 1856. *Discodon oppositipunctum*, Gorh., is not unlike the present species, but it is larger and has one of the claws of each foot cleft at the tip in ♂.

22. Polemius pauperculus.

Silis pauperculu, Gorh., Biol. Centr.-Am., Coleopt. iii, 2, p. 299 (exclud. specimen from Vera Cruz, and var. ?).

Moderately elongate, shining, finely pubescent; piceous or fuscous, the anterior and post-ocular portions of the head, the last two or three joints of the antennae in some specimens, the sides of the prothorax broadly, the sutural and outer margins of the elytra, and the legs in part or almost entirely (the base of the femora excepted), testaceous. Eyes very large in ♂, smaller in ♀. Antennae long in ♂, shorter in ♀. Mandibles simply curved in both sexes. Prothorax (♂) broader than long, strongly, obliquely grooved on each side anteriorly, the sides feebly notched at the middle, parallel thence to the acute, prominent hind angles, and broadly subangularly dilated in front of the median constriction, the base sinuate; (♀) broader, less narrowed behind, the shallow lateral notch wanting, and the ante-median projection thickened. Elytra moderately elongate, subparallel, wider than the prothorax, rather finely sculptured. Inner claw of anterior tarsi, and outer claw of intermediate tarsi, with an angular lobe at the base in ♂.

Length (excl. head) $3\frac{4}{5}$–5, breadth $1\frac{1}{10}$–$1\frac{2}{3}$ mm. (♂ ♀.)

Hab. Panama, Chiriqui.

Redescribed from sixteen examples, half of which are males. Very like *P.* (*Silis*) *oblita*, Gorh., some of the specimens having the last three joints of the antennae flavous; but differing from it in the angularly dilated, obliquely grooved sides of the prothorax in both sexes, the more sparsely pilose antennae of the male, and the simply curved mandibles of the female. The var.? mentioned by Gorham is referable to his *Silis ardua* and the Vera Paz specimen to *S. oblita*.

23. Polemius longicornis.

Silis longicornis, Gorh., Biol. Centr.-Am., Coleopt. iii, 2, p. 303 (♂) (*nec* Leconte, 1851).

Hab. Mexico, Oaxaca.

Described from three males, another specimen of the same sex having since been detected in the British Museum. In this insect (♂) the antennae are unusually elongate and serrate; the eyes are moderately large; the prothorax, the sides of the head in front, and the base of the mandibles are testaceous, and the rest of the body black; the elytra

are subgranulate and closely cinereo-pubescent; the prothorax is transverse, rounded-subquadrate, with the reflexed margins feebly notched behind the middle; and one of the claws of each foot is angularly dilated at the base. *P. megalophthalmus*, from Durango, is not unlike *P. longicornis*, but it has very large eyes, a longer prothorax, and still more elongate, serrate antennae, in the male, the scutellum yellow, etc.

24. **Polemius albimargo**, n. sp.

♂. Moderately elongate, very shining, sparsely pubescent; nigropiceous, the anterior margin of the head, the mandibles, antennae, prothorax, scutellum, coxae, and legs (the base of the posterior femora excepted), testaceous, the sutural and lateral margins of the elytra whitish. Head together with the enormously developed eyes wider than the prothorax, smooth, hollowed in the middle; antennae slender, as long as the body, joints 3–7 elongate (8–11 missing), 2 very small. Prothorax broad, transversely subquadrate, with narrowly reflexed margins, which are dilated into a rather broad, prominent, subangular tooth beyond the middle (appearing obliquely convergent thence to the apex) and gradually widened posteriorly to the subrectangular hind angles. Elytra considerably wider than the prothorax, moderately long, subparallel, rather sparsely, finely punctate.

Length (excl. head) $4\frac{3}{4}$, breadth 2 mm.

Hab. Costa Rica (*Mus. Brit., ex coll. Fry*).

One male, with the legs and antennae imperfect. A remarkably distinct form, having the general facies of *Silis ocularis*, Gorh., and the elytral coloration and sculpture of *Silis jocosa*; the prothorax, however, is very differently shaped from that of the male of either of these species. *P. albimargo* approaches *P.* (*Silis*) *amicula*, Gorh. (♂), but it is broader, the eyes are still larger, the antennae are longer and wholly testaceous, and the lateral prominence of the prothorax is wider and not followed by an oblique plica.

25. **Polemius amicula.**

Silis amicula, Gorh., Biol. Centr.-Am., Coleopt. iii, 2, p. 299 (♂ ♀).

♂. Eyes enormously developed; prothorax subquadrate, arcuate at the apex, narrowly margined laterally, the margins obliquely

plicate behind the stout, blunt, tooth-like, median prominence, the hind angles acute.

♀. Eyes much smaller; prothorax shorter, more narrowed anteriorly, the tooth-like lateral prominence smaller.

Hab. Panama, Bugaba and Caldera in Chiriqui.

Represented in the "Biologia" collection by seven specimens, two only of which are males, one of these (the type) having very large eyes, the other doubtless belonging to the next species. In this insect the sutural and outer margins of the elytra, the scutellum, and the basal margin of the prothorax are whitish, the rest of the prothorax being testaceous, and the disc of each elytron wholly or in part nigro-piceous; the front of the head, the base of the antennae, and the femora and tibiae are testaceous, the rest of the head black. There is less difference than usual in the general shape of the prothorax in the two sexes. The enormous eyes of the male were not mentioned by Gorham.

26. Polemius nigroplectrum.

Silis nigroplectrum, Gorh., Biol. Centr.-Am., Coleopt. iii, 2, p. 300 (♀).

Hab. Panama, Volcan de Chiriqui.

Smaller than *P. amicula*, the prothorax with the entire disc and the lateral tubercles black, the margins whitish, the antennae infuscate to the base. Described from two females. An immature male from Bugaba, with the legs and antennae slender and wholly testaceous, the fuscous dorsal stripe of the elytra reduced to a streak on the apical half, and the eyes much smaller in the male than in the same sex of *P. amicula*, probably belongs here. This pallid specimen was labelled *Silis amicula*, ♂, by Gorham.

27. Polemius basalis.

Silis basalis, Gorh., Biol. Centr.-Am., Coleopt. iii, 2, p. 94 (♂♀).

Polemius (?) *basalis*, Schaeff., Journ. N. York Ent. Soc. xvi, p. 62.

Hab. Guatemala, Purula in Vera Paz [types: ♂♀], Quiché Mts. [♀], Calderas [♂].

In the typical form of this species, of which a good series was captured at Purula, the head and prothorax, the base

of the elytra, the two basal joints of the antennae, the femora, tibiae, and under surface are testaceous, the legs, antennae and under surface being infuscate in the other examples. The male is described as having the prothorax subquadrate, with the margins (which are rather broadly reflexed) minutely excised behind the middle; but this definition is misleading, the narrow notch being straight and deep. The female has a broader, posteriorly widened prothorax, with trisinuate margins. The eyes of the male are smaller than in many of the allied forms; and the inner claw of the anterior tarsi is triangularly dilated at the base in this sex.

28. Polemius proximus.

♀. *Silis proxima*, Gorh., Biol. Centr.-Am., Coleopt. iii, 2, p. 298 (excl. ♂).

Moderately elongate, shining, finely pubescent; nigro-piceous, the head in front (♂) or at the sides before the eyes (♀), the basal joint of the antennae beneath, and the prothorax (a complete median vitta excepted, which is absent in one of the Chiacam types), stramineous or pale testaceous, the under surface and legs fuscous, the femora and base of the tibiae more or less testaceous. Eyes moderately large in ♂, smaller in ♀. Antennae (♂) long, stout, serrate, tapering outwards, and with joints 3–10 distinctly lineate or canaliculate, 2 very small; (♀) shorter and less dilated, moderately stout, tapering towards the tip. Mandibles curved in both sexes. Prothorax (♂) strongly transverse, feebly binodose near the base, the sides with a narrow, deep, straight notch a little behind the middle, parallel thence to the sharp hind angles, and abruptly converging at the apex, the explanate thickened margin forming an oblique dentiform prominence in front of the notch; (♀) broader and more explanate, the margins obsoletely plicate, bi- or trisinuate, converging from about the basal third forwards, the hind angles prominent. Elytra moderately long, at the base not or very little wider than the prothorax, parallel, densely sculptured, obsoletely costulate. Inner claw of anterior tarsi distinctly, and outer claw of the other tarsi more feebly, dilated at base in ♂.

Length (excl. head) 4–5, breadth $1\frac{1}{2}$–$1\frac{3}{4}$ mm. (♂ ♀.)

Hab. Mexico, Teapa in Tabasco (*H. H. Smith*: ♂ ♀); Guatemala, Chiacam in Alta Vera Paz [types, ♀].

A long series of this insect from Teapa is now available for examination, showing that the single male from Chiacam doubtfully referred by Gorham to *Silis proxima* belongs to

a different species, *P. dentimargo*; the numerous Mexican females agree perfectly with the specimen labelled type. The six males seen all have the antennae distinctly canaliculate. Both localities are on the Atlantic slope.

29. **Polemius medianus,** n. sp.

Moderately elongate, shining, finely pubescent; nigro-piceous, the head in front (♂) or at the sides before the eyes (♀), the basal joint of the antennae beneath, and the prothorax (a median vitta excepted), stramineous or testaceous, the legs piceous, the femora and base of the tibiae, at least in ♂, often testaceous. Head together with the eyes much wider than the prothorax in ♂, narrower in ♀; mandibles curved in both sexes; eyes enormously developed in ♂, small in ♀; antennae in ♂ about as long as the body, subserrate, clothed with short hairs, in ♀ much shorter and slightly tapering towards the tip. Prothorax (♂) transverse, arcuate in front, the sides with a straight, narrow notch at the middle and parallel thence to the rectangular hind angles; (♀) a little broader, with the sides somewhat rounded and rather narrowly explanate. Elytra moderately long, a little wider than the prothorax in both sexes, densely sculptured. Tarsal claws as in *P. proximus*.

Length (excl. head) $3\frac{1}{2}$–$4\frac{1}{4}$, breadth $1\frac{1}{2}$–$1\frac{3}{4}$ mm. (♂ ♀.)

Hab. Mexico, Teapa [types] (*H. H. Smith*: ♂ ♀); Guatemala, Cubilguitz [♂] and San Juan [♀] in Alta Verz Paz (*Champion*).

Three males and several females. Extremely like *P. proximus*, and sent with that insect from Teapa, from which it may be distinguished by the enormously developed eyes, the non-canaliculate antennae, and the narrower and less transverse prothorax of the male. The various females somewhat doubtfully referred to *P. medianus* are only separable from the same sex of *P. proximus* by their relatively narrower prothorax and darker legs. The single male from Cubilguitz was found placed under *P.* (*Silis*) *nigrita*, Gorh., in the "Biologia" collection; *Silis ocularis*, Gorh., ♂, has similar eyes.

30. **Polemius hirticornis,** n. sp.

♂. Moderately elongate, shining, finely pubescent; nigro-piceous, the front of the head, the prothorax (a narrow median vitta excepted), and legs (the outer joints of the tarsi excepted) stramineous or testaceous, the elytra piceous. Eyes enormously developed.

Antennae longer than the body, densely clothed with rather long projecting hairs, joints 3–11 very elongate, 2 extremely short, 3–7 gradually widened to the apex, 8–11 narrower. Prothorax transverse, arcuate in front, narrowing from the obtuse hind angles and obliquely sulcate on each side towards the apex, the groove impinging on the narrowly reflexed margin. Elytra wider than the prothorax, parallel, roughly sculptured. Tarsal claws as in *P. proximus*.

Length (excl. head) 4, breadth $1\frac{1}{6}$ mm.

Hab. Panama, Bugaba (*Champion*).

The above description is taken from a male from Bugaba in perfect condition found placed in the "Biologia" collection under *P.* (*Silis*) *nigrita*, Gorh., a very different Guatemalan insect. The greatly developed eyes in the male bring *P. hirticornis* near *P. medianus*, from the same sex of which it differs in its still longer, more serrate, and densely pilose antennae, and the much less quadrate prothorax, the sides of which are strongly and obliquely plicate towards the apex, instead of at the middle. A dissected female from the same locality placed (but not quoted) by Gorham under *P.* (*Silis*) *proximus*, with the antennae formed as in that insect, probably belongs to the present species, the prothorax being plicate laterally much as in the type of *P. hirticornis*.

31. **Polemius dentimargo**, n. sp. (Plate VIII, fig. 61, prothorax, ♂.)

Silis proxima, Gorh., Biol. Centr.-Am., Coleopt. iii, 2, p. 298 (♂, *nec* ♀).

♂. Moderately elongate, shining, clothed with long pallid hairs; piceous or fuscous, the sides of the head before and behind the eyes, the base of the mandibles, the prothorax (a narrow median vitta excepted), the sutural and outer margins of the elytra, the humeri, and the legs in great part (the anterior and intermediate tibiae and tarsi excepted), pale testaceous. Antennae long, slender, sparsely pilose. Eyes very large. Prothorax transverse, the sides explanate and feebly reflexed, dilated into a broad subangular tooth before the middle, angularly notched behind this, and constricted at the base, the hind angles acute, the base sinuate. Elytra long, subparallel, wider than the prothorax, roughly sculptured. Inner claw of anterior tarsi, and outer claw of the other tarsi, angularly dilated at the base.

Length (excl. head) $4\frac{1}{2}$–$4\frac{3}{4}$, breadth $1\frac{1}{2}$ mm.

Hab. GUATEMALA, Chiacam and Cubilguitz in Alta Vera Paz.

Two males, agreeing perfectly *inter se*. Gorham's description of *Silis proxima*, from Chiacam, was taken from the female, the male provisionally referred to it by him proving to belong to a different species now that both sexes of *P. proximus* are definitely known. *P. dentimargo*, in fact, comes very near *P.* (*Silis*) *pauperculus*, Gorh., from Chiriqui; but it has the prothorax (of the male) less narrowed behind, with the margins more distinctly notched at the middle, and the deep oblique lateral sulci shallower and straighter.

32. **Polemius minutus.** (Plate VIII, fig. 62, prothorax, ♂.)

Silis minuta, Gorh., Biol. Centr.-Am., Coleopt. iii, 2, p. 305 (♂).

Hab. GUATEMALA, Zapote, on the slope of the Volcan de Fuego.

P. (*Silis*) *minutus* is represented in the "Biologia" collection by two males from Zapote, mounted by their captor on the same piece of card, and labelled "type" by Gorham. They belong to different species, but the description can only have been made from one of them, that with the whole of the anterior portion of the head whitish and the femora testaceous to near the tip. This specimen, the actual type, has the prothorax rufo-testaceous, with a black median vitta and sharply defined whitish margins, interrupted at the middle by an outward extension of the reddish coloration. It has the eyes small, but prominent; the antennae moderately long, with very short second joint; the prothorax strongly transverse, hollowed down the centre, with the reflexed margins plicate and narrowly excised behind the middle, the lobe in front of it rounded externally and not very prominent, the hind angles rectangular; the elytra parallel and roughly sculptured. The somewhat similar *Discodon* (*Silis*) *minusculum*, Gorh., from the same locality, has the sides of the prothorax of the male dilated anteriorly into a broad angular lobe and the lateral excision broader and placed further forward, the second antennal joint longer, the three tarsal claws cleft, etc.

33. **Polemius xanthoderes**, n. sp.

♂. Comparatively short, shining, clothed with rather coarse cinereous pubescence; black, the sides of the head in front, the mandibles, the two basal joints of the antennae beneath, the prothorax, the tibiae to near the apex, and the tarsal claws, testaceous or rufo-testaceous. Eyes small. Antennae rather stout, about reaching the middle of the elytra. Prothorax short and broad, transversely subquadrate, the margins narrowly reflexed, angularly notched at the middle, and slightly thickened in front of the emargination. Elytra rather short, subparallel, roughly sculptured. Inner claw of anterior tarsi, and outer claw of the other tarsi, simply dilated at base.

Length (excl. head) 3–3⅛, breadth 1$\frac{1}{10}$–1½ mm.

Hab. Mexico, Tierra Colorada in Guerrero (*H. H. Smith*).

Two males. A very small shining insect, with a broad, transversely subquadrate, mesially notched prothorax in the male, and comparatively short elytra, the prothorax and the tibiae in part testaceous, the rest of the surface almost entirely black. Amongst the species described by Gorham *P. xanthoderes* is perhaps nearest related to *P.* (*Silis*) *minutus*.

34. **Polemius cavicollis**, n. sp.

♂. Comparatively short, shining, thickly pubescent; black, the points of insertion of the antennae, the mandibles, and prothorax (a transverse patch on the disc at the base excepted) testaceous. Eyes moderately large. Antennae long, nearly reaching the apex of the elytra, closely pilose. Prothorax small, transverse, hollowed down the middle behind, rounded at the sides, the margins explanate, reflexed, obliquely plicate, and deeply sinuate before the prominent hind angles. Elytra rather short, subparallel, and roughly sculptured. Inner claw of anterior tarsi, and outer claw of the other tarsi, feebly dilated at base.

Length (excl. head) 3⅛, breadth 1½ mm.

Hab. Mexico, Rincon in Guerrero, 2800 ft. (*H. H. Smith*).

One male. A little more elongate than *P. xanthoderes* (♂), the eyes larger, the antennae much longer, the legs wholly infuscate, the prothorax rounded at the sides, the latter hollowed and obliquely plicate behind the middle, the hind angles prominent, the disc deeply excavate posteriorly.

35. **Polemius ornaticollis,** n. sp. (Plate VIII, fig. 63, prothorax, ♂.)

Rather short, shining, finely pubescent; black or piceous, the sides of the head in front, the mandibles, and sometimes the base of the antennae and the femora in part, testaceous, the prothorax rufo-testaceous, with a black median vitta of variable breadth and interrupted whitish margins, the lateral prominences of ♂ blackish in one specimen. Eyes small and antennae long in both sexes, joint 2 of the latter very short. Prothorax (♂) transversely subquadrate, bicallose on the disc posteriorly, notched at the middle on each side and with a small blunt tooth in front of the emargination, the narrowly dilated margins gradually becoming a little wider towards the rectangular hind angles; (♀) broader, more widened posteriorly, the margins more expanded, plicate, and simply sinuate before and behind the middle. Elytra comparatively short, slightly widened posteriorly, roughly, densely sculptured and obsoletely costate.

Length (excl. head) 3–4, breadth $1\frac{1}{4}$–$1\frac{1}{2}$ mm. (♂ ♀.)

Hab. Mexico, Tapachula (*Höge*: ♀), Teapa (*H. H. Smith*: ♂); Guatemala, Zapote, Pacific slope (*Champion*: ♂ ♀).

Described from four examples, the pair from Zapote (including the male left by Gorham under his *Silis minuta*) being taken as the types, varying in the development of the black median vitta of the prothorax, this being dilated towards the base and apex in the Zapote male. The dark head and legs, and the very differently shaped prothorax of the male, separate *P. ornaticollis* from *P. minutus*. The tricoloured prothorax is common to various allied forms. One of the smallest species of the group.

The following species cannot be definitely located till the males are discovered.

36. **Polemius mimetus.**

♀. *Telephorus* (*Silis*?) *mimetus*, Gorh., Biol. Centr.-Am., Coleopt. iii, 2, pp. 90, 289.

Moderately elongate, narrow, finely pubescent; opaque, black, the entire anterior portion of the head, the sides of the latter behind the eyes, the sides of the prothorax, and the humeri flavous; head large; eyes small; mandibles curved; antennae short, rather

slender, joint 2 about half the length of 3; prothorax transversely subquadrate, uneven, the margins narrowly reflexed, trisinuate, dilated into a blunt tooth anteriorly, and with acute projecting hind angles; elytra moderately long, wider than the prothorax, subparallel, finely sculptured and obsoletely costate; legs slender.

Hab. GUATEMALA, Zapote, Cerro Zunil, both on the Pacific slope.

Three females seen. This insect can be provisionally placed under *Polemius*; it has obviously nothing to do with *Telephorus* sensu stricto.

37. Polemius rugipennis.

Telephorus rugipennis, Gorh., Biol. Centr.-Am., Coleopt. iii, 2, p. 90.

♀. Anterior portion of head, base of antennae, reflexed margins of prothorax, and a large subquadrate space on each side behind, coxae, and femora to near the tip, flavous or testaceous, the rest of the body in great part nigro-piceous. Eyes small; mandibles curved; apical joint of palpi stout; antennae long, rather slender, joints 3–11 flattened, slightly tapering towards the tip; prothorax transverse, the margins rounded, feebly sinuate, reflexed throughout, the hind angles acute, the disc excavate down the middle posteriorly; elytra rather coarsely, densely, granulato-punctate and feebly costulate.

Hab. GUATEMALA, Zapote, on the slope of the Volcan de Fuego.

Gorham was unable to identify the sex of the three specimens he described under the name *T. rugipennis*: they are certainly females. The rough elytral sculpture is suggestive of that of *Silis sicula*, Gorh., approaching that of *Parasilis*.

SILIS.

Silis, Latreille, Règne Anim., ed. 2, iv, p. 47 (1829); Leconte, Trans. Am. Ent. Soc. v, p. 60 (1874), and ix, p. 56 (1881); Gorham, Biol. Centr.-Am., Coleopt. iii, 2, p. 91 (1881) (part.).

Ditemnus, Leconte, Class. Coleopt. N. Am. p. 189 (1861); Trans. Am. Ent. Soc. ix, p. 57.

The heterogeneous forms here placed under *Silis*, after

the elimination of all those included in it by Gorham with one or more of the tarsal claws cleft in male, should perhaps be referred to more than one genus; but I am unable to find any structural characters upon which to divide them. There is every gradation in the form of the armature of the margins of the prothorax, from long lobes to short teeth, and the species here included under Section II would be equally well placed under *Polemius*, in which the lateral margins are, at most, simply notched or interrupted in the male, *i. e.* as in *Discodon*. *Ditemnus* (type *Silis lepida*, Lec. = *Cantharis bidentata*, Say) is nearly related to the European *Silis ruficollis*, F., and the Mexican *S. longidens* to the European *S. nitidula*, F. The single species referred to Section III, *S. chalybeipennis*, Gorh., will doubtless, sooner or later, have to form the type of a separate genus. *Silis*, as understood here, may be defined thus: prothorax with the lateral margins incised or constricted at or towards the base, and sometimes (*Ditemnus*) deeply incised at about the middle also, the margins more or less lobed, lamellate, or dentate, the lobes often imbricate, the tarsal claws uncleft, and the seventh ventral segment divided down the middle, in ♂. The typical forms have small eyes and rather stout serrate antennae, but this definition does not apply to many species placed under Section II. We are indebted to Mr. H. C. Fall for specimens of several of the described N.-American representatives of the genus for comparison.

The Central American species of *Silis* may be grouped by their ♂ characters thus * :—

Silis.

I. Prothoracic margins deeply bi-incised, and also strongly bi- or trilobed.
  a. Lateral lobes long, convergent: species elongate, black, Telephoriform . . . *Species* 1.
  b. Lateral lobes lamelliform, directed backwards or imbricate: species smaller and less elongate.
    a^1. Inner anterior tarsal claw with a stout angular lobe at base: species Malachiiform, black . . . . . *Species* 2.

* Females only known of species 18, 34.

b^1. Inner anterior tarsal claw simply dilated at base.
a^2. Species Telephoriform [= *Ditemnus*, Lec.] . . . . . *Species* 3–14.
b^2. Species Lyciform . . . . . *Species* 15.

II. Prothoracic margins with a single median or post-median incision.
c. Prothorax subcampanulate, the margins with a very deep post-median notch limited in front and behind by a sinuous dentiform process; eyes large: species Lyciform . . . . . *Species* 16.
d. Prothorax transversely suborbiculate, the margins with a deep oblique notch at middle, limited in front and behind by a backwardly-curved lamella; eyes large: species small, Lyciform . . . . . *Species* 17, 18.
e. Prothorax small, transverse, the margins with a narrow deep oblique notch towards base, limited in front by a long backwardly directed process and behind by a short sub-bidentate lamella; eyes small: species small, Lyciform . *Species* 19.
f. Prothorax transversely orbiculate, the margins notched or plicate at or behind middle and more or less dentate: species small, Lyciform or Telephoriform . . *Species* 20–32.
g. Prothorax with the margins dilated into a backwardly-directed lobe or blunt tooth before base: species small, Telephoriform . . . . . *Species* 33, 34.

III. Prothoracic margins very deeply incised at base, and also notched at middle; elytra metallic: species Telephoriform . . . . . *Species* 35.

Species of doubtful position, females only known . . . . . *Species*, 36–38.

1. **Silis longidens**, n. sp. (Plate VIII, fig. 64, prothorax, ♂.)

♂. Elongate, shining, finely cinereo-pubescent; black, the head on each side in front, the base of the mandibles, the prothorax with the reflexed margins and the tips of the lateral teeth, the anterior trochanters, and the tarsal claws, testaceous or whitish.

Head closely, minutely punctate; eyes moderately large; antennae long and slender (joints 8–11 missing). Prothorax transverse, bicallose on the disc posteriorly; the margins narrowly reflexed, dilated laterally into two very long, prominent, convergent teeth, the one in front of the deep median excision narrow, obliquely curved outwards, the other broader, flattened and lobiform, curved forwards, obliquely truncate at the tip, and armed with a small tooth on its anterior edge towards the base; the reflexed basal margin dilated laterally into a sharp tooth; the surface sparsely, very minutely punctate. Elytra long, parallel, wider than the prothorax, sparsely, finely punctate. Inner claw of anterior tarsi, and outer claw of the other tarsi, with a dentiform lobe at the base.

Length (excl. head) $7\frac{1}{5}$, breadth $2\frac{1}{3}$ mm.

Hab. Mexico, Omilteme in Guerrero, 8000 ft. (*H. H. Smith*).

One male, wholly unlike any of the Mexican forms described by Gorham. *S. longidens* is of about the size and shape of the insect here described under the name of *Discodon melanopterum*, from the same locality; but it could not possibly be the male of that species, which is known from females only, these latter having much more densely sculptured elytra. The two convergent lateral teeth of the prothorax are very long and prominent, and separated by a deep incision, much as in the European *S. nitidula*, F.

2. **Silis laticollis.** (Plate VIII, fig. 65, prothorax, ♂.)

Silis laticollis, Gorh., Biol. Centr.-Am., Coleopt. iii, 2, p. 97, pl. 6, fig. 17 (♂).

Hab. Mexico, Jacale [? = Jacala in Hidalgo].

Two males of this remarkable *Silis* are contained in the "Biologia" collection. It is a broad, robust, shining, cinereo-pubescent, black insect, with the apex of the abdomen and the base of the mandibles testaceous. The prothorax is much broader than the elytra, and has the two long, convergent, lateral, post-median lobes separated by a very deep oblique excision. The elytra are parallel, short (not covering the abdomen), and coarsely punctured. The legs and antennae are rather stout, the latter closely pilose. The inner claw of the anterior tarsi is strongly lobed, and the outer claw of the other tarsi angularly dilated, at the base. Schaeffer has described an allied form, *S. nigerrima*, from Arizona.

3. **Silis distorta.** (Plate VIII, fig. 66, prothorax, ♂.)

Silis distorta, Gorh., Biol. Centr.-Am., Coleopt. iii, 2, p. 95 (♂ ♀).

Hab. Guatemala, Pacific slope and vicinity of the capital.

This species, of which a long series was obtained, may be known from *S. dilacerata* by the larger and broader prothorax of the male, the lateral lobes of which are broad, imbricate, and directed backward; the prothorax of the female, too, is less transverse than in *S. dilacerata*, and in both sexes it is much suffused with black on the disc, the space between the dark patch and the flavous outer and anterior margins being partly red. The outer limb of the elytra is sometimes testaceous at the base. The mandibles of the female are curved.

4. **Silis torticollis.** (Plate VIII, fig. 67, prothorax, ♂.)

Silis torticollis, Gorh., Centr.-Am., Coleopt. iii, 2, p. 301 (♂ ♀).

♂. Prothorax short, as broad as, or broader than, the elytra, narrow at the base, excavate down the middle, strongly trilobate laterally—the anterior lobe curved backward, rounded in front, and deeply excavate behind, the others oblique and contiguous (the anterior one narrow, the other broad); elytra rather shining, with an elongate space on the disc beyond the middle impressed with irregular rows of coarse punctures, the rest of their surface very finely sculptured; inner claw of anterior tarsi angularly dilated at the base.

♀. Prothorax narrower than the elytra, the margins deeply excised at the middle and with a stout blunt in front of the emargination; elytra opaque, finely sculptured throughout; mandibles bent; eyes smaller than in ♂; antennae shorter and less serrate than in ♂.

Hab. Panama, near the city [♂] and San Miguel in the Pearl Islands. [♂ ♀, types.]

A small nigro-fuscous insect, with the anterior portion of the head, the mandibles, and the prothorax wholly or with the lateral portions broadly, testaceous. Six males and three females seen, one pair only having the prothorax immaculate. The sexual differences in the elytral sculpture were not noticed by Gorham.

5. **Silis trilobata,** n. sp. (Plate VIII, fig. 68, prothorax, ♂.)

Silis dilacerata, Gorh., Biol. Centr.-Am., Coleopt. iii, 2, p. 96 (part.).

Comparatively short, the head and prothorax shining, the elytra dull, thickly pubescent; nigro-piceous, the mandibles and prothorax (a broad median vitta excepted, this being dilated at the base and apex in ♂) rufous or testaceous, the outer limb of the elytra obscure testaceous. Eyes small. Mandibles curved. Antennae stout, moderately long, tapering outwards. Prothorax (♂) strongly transverse, as broad as the elytra, narrow at the base, very deeply excavate on the disc, trilobate at the sides—the anterior lobe rather long and narrow, reflexed and somewhat rounded externally, and truncate behind, the posterior lobe longer, oblique, and cleft into two, the upper portion broad and laminiform, the lower (posterior portion) longer and narrower, both truncate at the apex; (♀) simply sinuato-emarginate at the sides before the hind angles. Elytra rather short, widened posteriorly in ♂, subparallel in ♀, rather finely sculptured.

Length (excl. head) $4\frac{1}{4}$–5, breadth 2–$2\frac{1}{10}$ mm. (♂ ♀.)

Hab. Mexico (*Truqui, in Mus. Brit.*: ♀), Juquila in Oaxaca (*Salle*: ♂ ♀).

One male and two females, the pair from Juquila quoted by Gorham under *S. dilacerata.* The lateral armature of the ♂ prothorax is very different in these two species, the oblique posterior lobe in *S. trilobata* being divided into two laminiform truncated processes. The two females have the disc of the prothorax broadly vittate and deeply excavate.

6. **Silis dilacerata.** (Plate VIII, fig. 69, prothorax, ♂.)

Silis dilacerata, Gorh., Biol. Centr.-Am., Coleopt. iii, 2, p. 96, pl. 6, fig. 4 (♂) (part.).

♂. Eyes small; antennae subserrate, rather stout, moderately long, tapering outwards; prothorax as broad as the elytra, narrow at the base, deeply excavate on the disc, with two long lobes projecting outwards on each side, the anterior lobe rounded externally and (as seen from behind) subtruncate posteriorly, the posterior lobe oblique, unarmed in front, and more or less cleft at the tip.

♀. Prothorax simply emarginate at the sides before the base.

♂. Ninth ventral segment transverse, the partially evaginated

internal sac disclosing a stout hook on each side and a pair of long, slender, strongly curved hooks in the middle. (Fig. 36.)

Hab. Mexico (*Mus. Brit.*, *Truqui*), Orizaba, Jalapa, Vera Cruz, Frontera, Teapa; Guatemala, Capetillo [type], Guatemala City, San Gerónimo.

Var. ? Anterior lateral lobe of the prothorax of ♂ extending further backward, sinuate externally, and drawn out at the apex into a blunt tooth, the posterior lobe broader, apparently arising from nearer the base, cleft at the tip.

Hab. Mexico, Cuernavaca.

Var. ? Anterior lateral lobe of the prothorax of ♂ curved backward, its posterior margin oblique, the posterior lobe cleft as in typical *S. dilacerata*; prothorax of ♀ simply emarginate on each side before the hind angles.

Hab. Panama, Volcan de Chiriqui.

Various species were included under *S. dilacerata* by Gorham, including one from San Gerónimo with a pale elytral suture and very large eyes in the male, *S. biauriculata*. The type (♂) figured by him was from Capetillo. The specimens from Chontales, Chiacam, Purula, etc., have an erect spine on the posterior lobe of the prothorax of the male, and conspicuous whitish lateral margins to the elytra: they are here separated under the name *acantholobus*. The Juquila insect, again, *S. trilobata*, has the lateral armature of the ♂ prothorax differently formed. The varieties of *S. dilacerata* from Cuernavaca and Chiriqui, the former represented by a single male, and the latter (not mentioned by Gorham) by two males and one female, may have to be separated when more material is obtained. The black median vitta of the prothorax is often obsolete in both *S. dilacerata* and *S. acantholobus*. The outer limb of the elytra is usually pale testaceous in the present species. In one female of the latter the prothoracic depression is wanting.

7. **Silis acantholobus**, n. sp. (Plate VIII, fig. 70, prothorax, ♂.)

Silis dilacerata, var., Gorh., Biol. Centr.-Am., Coleopt. iii, 2, p. 96.

Moderately elongate, shining, finely pubescent; nigro-piceous or black, the anterior margin of the head, the base of the mandibles,

the basal joints of the antennae beneath, the margins of the prothorax, and the outer limb of the elytra flavescent or whitish, the rest of the prothorax rufous or rufo-testaceous, often with a complete or abbreviated black median vitta. Head transversely depressed or flattened between the eyes, the latter small in both sexes; antennae not very stout, extending to beyond the middle of the elytra in ♂, shorter in ♀. Prothorax (♂) transverse, as wide as or wider than the elytra, narrow at the base, deeply excavate and often sulcate on the disc, the lateral lobes broad—the anterior one curved backward and ciliate, the posterior one oblique, truncate at the apex, pointed at the outer angle, and armed on its anterior edge near the base with a slender erect, dentiform process, which is obliquely truncate or bidentate at the tip; (♀) simply notched on each side before the hind angles, the dorsal excavation shallower and often divided into two. Elytra subparallel, finely sculptured.

Length (excl. head) $4\frac{1}{8}$–$5\frac{1}{3}$, breadth $1\frac{1}{2}$–$2\frac{1}{10}$ mm. (♂ ♀.)

Hab. Mexico (*Mus. Brit.*, *Mus. Oxon.*), Orizaba, Cordova, Atoyac, Jalapa, Teapa, Capulalpam, Tehuantepec; ? Honduras; Guatemala, Purula and Chiacam in Alta Vera Paz; Nicaragua, Chontales.

Gorham separated the Chontales and some other specimens from *S. dilacerata* as a variety on account of their wholly red prothorax (a character of no value); but he did not notice the slender erect dentiform process on the anterior margin of the posterior lateral lobe of the prothorax of the numerous males before him, which is perfectly constant in the large number of specimens of this sex from Teapa and other places examined by me. *S. acantholobus*, too, is a more elongate insect than *S. dilacerata*, the elytra are more shining and have a more definite whitish lateral margin, and the antennae of the male are longer and not so stout. The Jalapa female mentioned by Gorham under *S. ludicra* (loc. cit. p. 302) belongs here.

8. **Silis biauriculata,** n. sp. (Plate VIII, fig. 71, prothorax, ♂.)

Silis dilacerata, Gorh., Biol. Centr.-Am., Coleopt. iii, 2, p. 96 (part.).

♂. Moderately elongate, narrow, shining, somewhat thickly pubescent; nigro-piceous, the anterior portion of the head, the prothorax and scutellum, the sutural and outer margins of the elytra narrowly, and the extreme base of the tibiae, testaceous or

rufo-testaceous. Eyes very large; antennae long, distinctly serrate, rather slender. Prothorax strongly transverse, as wide as the elytra, narrow at the base, broadly excavate and canaliculate on the disc, with strongly developed, overlapping, oblique lateral lobes—the anterior lobe broad, emarginate and ciliate behind, the inner imbricate portion triangular, the posterior lobe truncate externally. Elytra long, subparallel, finely sculptured. Inner claw of anterior tarsi angularly dilated at base.

Length (excl. head) 5–5½, breadth 1½–1⅘ mm.

Hab. Guatemala, San Gerónimo in Baja Vera Paz.

Two males, included by Gorham under *S. dilacerata*. The only other Central American species of this section with greatly enlarged eyes in the male is *S. festiva*, from Chiriqui, which has posteriorly dilated elytra, pale legs and antennae, etc. The longer elytra, with pale suture, and the emarginate anterior lateral lobe of the prothorax and the large eyes of the male, separate *S. biauriculata* from *S. dilacerata*, etc.

9. **Silis bilamellata,** n. sp. (Plate VIII, fig. 72, prothorax, ♂.)

♂. Moderately elongate, shining, finely pubescent; nigro-piceous, the anterior portion of the head, the base of the mandibles, the reflexed edges of the prothorax in part, the scutellum, and the sutural and outer margins of the elytra, whitish, the rest of the prothorax rufo-testaceous (in the Pearl Island example fuscous, with an oblong reddish patch on the middle of the disc), the knees testaceous. Eyes moderately large. Antennae long, distinctly serrate. Prothorax strongly transverse, not wider than the base of the elytra, excavate on the disc, with two rather broad, overlapping lateral lobes, the anterior lobe directed backward and rounded externally, the posterior lobe directed straight outward and truncate at the apex. Elytra moderately long, subparallel, finely sculptured.

Length (excl. head) 4½–5, breadth 1⅔ mm.

Hab. Guatemala, San José on the Pacific coast [type]; Panama, San Miguel in the Pearl Is.

Two males, the one from Guatemala mentioned by Gorham in his remarks on *S. ludicra*, the other from the Pearl Is. labelled by him as *Silis* n. sp. near *torticollis*. These two examples agree perfectly in the form of the lateral lobes of the ♂ prothorax, but the Panama specimen has less elongate elytra, the disc of the prothorax infuscate on each side, and the eyes slightly smaller. *S. biauriculata*,

S. albicincta, and *S. ludicra* are similarly coloured forms, but they differ in the shape of the ♂ prothorax, the first-mentioned also having much larger eyes in the male. *S. bilamellata* may be confined to the sea-coast.

10. **Silis ludicra.** (Plate VIII, fig. 73, prothorax, ♂.)

Silis ludicra, Gorh., Biol. Centr.-Am., Coleopt. iii, 2, p. 302 (♂).

Silis ludicra, var. *nigroscutellaris*, Pic, Le Nat. 1910, p. 44 (♂).

Hab. Mexico, Presidio in Durango [type].

This species was described from a single male example. It is a comparatively broad, robust, rather coarsely pubescent insect, with the pallid anterior portion of the head extending angularly upwards in the middle, the prothorax, the basal joints of the antennae beneath, the scutellum, and the femora to near the tip, testaceous, the rest of the head and the elytra, the pallid sutural and outer margins excepted, nigro-fuscous or black. The antennae are moderately long and stout, tapering outwards; the eyes are small; the prothorax is wider than the elytra at the base, broadly excavate and bifoveate on the disc, and has two broad overlapping lateral lobes, the anterior lobe ciliate and curved inward, the posterior lobe extending further outward, and truncate at the tip; and the elytra are comparatively short, and moderately explanate at the sides. The female from Jalapa mentioned by Gorham as possibly pertaining to *S. ludicra* is here referred to *S. acantholobus*, and the male from San José on the Guatemalan coast, to *S. bilamellata*. Pic has described a variety of *S. ludicra*, from Mexico, under the name *nigroscutellaris*—"Écusson et pattes foncés, pour le reste coloration du *ludicra*, Gorh. Robuste, avec le prothorax fortement et longuement bilobé latéralement, à lobe antérieur dentiforme, postérieur subtronqué au sommet."

11. **Silis albicincta.** (Plate IX, figs. 74, 75, prothorax, ♂.)

Silis albicincta, Gorh., Biol. Centr.-Am., Coleopt. iii, 2, p. 96, pl. 6, fig. 5 (♂) (excl. var. from Chiriqui).

Hab. Costa Rica, Irazu [♂ ♀].

Var. Prothorax (♂) broader, the anterior lateral lobe wider, rounded externally, the posterior lobe directed outwards beneath the

anterior one (as in the type) (fig. 75); elytra (♂) slightly shorter and less broadly explanate posteriorly.

Hab. Mexico (*Mus. Brit.*), Cordova, Toxpam, Teapa [♂ ♀].

The type of this insect, a male from Irazu, has a small, feebly developed prothorax, with a narrow bent anterior lateral lobe, and the elytra long and somewhat broadly explanate posteriorly. The Mexican examples seen (4 ♂♂ and 1 ♀) are slightly different and may have to be separated. The head (except along the anterior margin) and elytra are black, the latter with the sutural and outer margins white or pale testaceous, the prothorax and scutellum are testaceous, and the legs, antennae, and under surface are infuscate. The female has the sides of the prothorax simply notched before the hind angles and convergent thence to the apex. The prothorax of the male has a very deep fovea in the centre of the median excavation.

12. **Silis jocosa.** (Plate IX, fig. 76, prothorax, ♂.)

Silis albicincta, var., Gorh., Biol. Centr.-Am., Coleopt. iii, 2, p. 96 (part.).
Silis jocosa, Gorh., loc. cit. p. 301.

Hab. Panama, Volcan de Chiriqui, Bugaba.

Differs from *S. albicincta* in the testaceous head, antennae, and legs; the less elongate shape, with the elytra still more dilated posteriorly; the smaller eyes in the male; and the broader prothorax in both sexes, that of the male being much wider than the elytra and with longer and stouter overlapping lateral lobes, the anterior lobe hollowed above and obliquely sagittiform and ciliate behind, leaving a minute window-like opening visible between them. The female has a broader head and the prothorax narrowly notched at the hind angles. Of the twelve specimens seen, three only are males.

13. **Silis festiva.** (Plate IX, fig. 77, prothorax, ♂.)

Silis albicincta, var., Gorh., Biol. Centr.-Am., Coleopt. iii, 2, p. 96 (part.).
Silis festiva, Gorh., loc. cit. p. 301 (♂ ♀).
Silis albicincta, var. *testaceipes*, Pic, L'Échange, xxvi, p. 6 (1910).

Hab. Panama, Volcan de Chiriqui.

Differs from *S. albicincta* in the testaceous antennae and legs, the very large eyes of the male, and the broader prothorax in both sexes, that of the male with longer lateral lobes, the anterior lobe angulate externally (as in *S. albicincta*), the posterior lobe narrow as seen from above and strongly sinuate. The black head, and the large eyes and less dilated prothorax of the male, the latter with narrow, differently shaped lobes, separate *S. festiva* from *S. jocosa*, an insect occurring at the same locality. Fifteen specimens seen, four of which are males.

As stated by Gorham (loc. cit. pp. 301, 302), *S. festiva* and *S. jocosa* were originally recorded by him as varieties of *S. albicincta*.

14. **Silis erythrodiscus,** n. sp. (Plate IX, fig. 78, prothorax, ♂.)

Silis sp. no. 24, Gorh., Biol. Centr.-Am., Coleopt. iii, 2, p. 306 (♂).

♂. Comparatively short, rather broad, the head and prothorax shining, the elytra opaque, closely fusco-pubescent; black, the prothorax with the entire disc or two transversely placed spots, and the base of the mandibles rufous or rufo-testaceous. Eyes small. Antennae stout, feebly serrate, moderately long. Prothorax short, strongly transverse, feebly canaliculate and broadly, deeply excavate on the disc posteriorly, the space on either side of the cavity tumid, the margins reflexed, bilobate towards the base—the anterior lobe oblique, stout, rounded externally, the posterior lobe narrow, curved, arising from just in front of the sharply reflexed basal margin, and armed with a short slender hook near the apex anteriorly. Elytra comparatively short, blunt at the tip, somewhat explanate laterally from a little below the base, finely sculptured. Legs stout.

Length (excl. head) 4–4½, breadth 1⅔–2 mm.

Hab. Mexico (*Truqui, in Mus. Brit.*), Ciudad in Durango (*Forrer*), Cuernavaca (*Höge*).

Three males, including the one from Durango left unnamed by Gorham, the rufescent portion of the disc of the prothorax in the latter reduced to two spots. In this insect the lateral lobes of the prothorax are narrowly separated and placed further back than usual, and the legs and antennae are stout. The black-margined rufescent prothorax is suggestive of the Guatemalan *Silis sicula*

(known from females only), but the latter has rugosely punctate elytra, etc. *S. erythrodiscus*, therefore, has no near known ally amongst the species here enumerated.

15. **Silis laciniosa,** n. sp. (Plate IX, fig. 79, prothorax, ♂.)

♂. *Silis eroides*, Gorh., Biol. Centr.-Am., Coleopt. iii, 2, p. 296 (part.) (*nec* p. 94).

♂. Moderately elongate, flattened, opaque, thickly pubescent; black, the anterior portion of the head, the mandibles, the sides of the prothorax broadly, and the sides of the elytra to near the apex, to a greater or less extent (leaving a large, anteriorly-narrowed, common black apical patch, which extends broadly up the suture to the base), ochreous. Eyes large (together with the head not so wide as the prothorax); antennae long, dilated and strongly serrate from the third joint, slightly tapering outwards, thickly set with short projecting hairs. Prothorax strongly transverse, about as wide as the basal portion of the elytra, uneven on the disc, broadly arcuate in front, narrow and parallel-sided at the extreme base, the margins reflexed, plicate, and with two overlapping lobes, the anterior one long, backwardly-directed, the posterior one narrow, oblique, arising from near the base, and clubbed at the tip. Elytra moderately long, hard, flattened on the disc, gradually widened to the apex, densely sculptured and obsoletely costate. Inner claw of anterior tarsi, and outer claw of the other tarsi, feebly dilated at the base.

Length (excl. head) 4½–5, breadth 1⅘–2 mm.

Hab. Panama, Bugaba.

Described from three precisely similar males. Gorham called attention to the deeply laciniate edges of the prothorax, and the long hind lobe, of these ♂ specimens from Bugaba, and says that both sexes were captured there. No female from that locality is now to be found in the "Biologia" collection. *S. laciniosa* has obviously nothing to do with the similarly coloured *S. eroides* from Guatemala, the smaller eyes, sharply serrate antennae, and the broader, very differently shaped prothorax readily distinguishing the present species, at least in the male sex.

16. **Silis lycoides.** (Plate IX, figs. 80, 81, prothorax, ♂, ♀.)

♀. *Silis lycoides*, Gorh., Biol. Centr.-Am., Coleopt. iii, 2, pp. 91, 290, pl. 5, fig. 21 (♀, not ♂) (part.).
♂. *Silis praemorsa*, Gorh., loc. cit. p. 93.

♂. Eyes large; antennae long, feebly subserrate, rather slender, scarcely narrowed towards the apex; prothorax (fig. 80) narrow, subcampanulate, with a rather broad, very deep, abrupt notch on each side towards the base, the dilated margins drawn out into a long, curved, oblique dentiform prominence in front of the excision and an oblique subtriangular lamella behind it, the latter subtruncate and feebly emarginate at the tip, the hind angles obliterated; inner claw of anterior tarsi, and outer claw of the other tarsi, somewhat dilated at the base.

♀. Eyes much smaller; mandibles curved; antennae short, very stout, joints 3–11 broadly dilated, becoming gradually narrower towards the apex; prothorax (fig. 81) broader, transverse, narrowing from the base, the margins strongly trisinuate, the hind angles prominent.

Hab. GUATEMALA, San Gerónimo [type of ♀], Purula [♀], Cerro Zunil [♀ and type of ♂].

Gorham (loc. cit. p. 290) correctly surmised that *S. praemorsa* was the male of his *S. lycoides*, more especially as the two sexes were obtained at the same locality, Cerro Zunil. This Lyciform insect is separable from its allies by the posteriorly dilated, strongly costate elytra, and opaque upper surface, the peculiarly notched prothorax, uncleft tarsal claws, and large eyes of the male, etc. The ochreous humeral patch of the elytra, and the median vitta of the head and prothorax, varies in development, the rest of the body being black. One male and three females seen. A female from Cordova, Mexico, with more feebly costate, almost wholly ochraceous elytra, treated by Gorham as a variety of *S. lycoides*, probably belongs to a different species.

17. **Silis eroides.** (Plate IX, fig. 82, prothorax, ♂.)

Silis eroides, Gorh., Biol. Centr.-Am., Coleopt. iii, 2, p. 94, pl. 6, fig. 6 (♂) (part.) (*nec* p. 296).

♂. Eyes very large (together with the head broader than the prothorax); antennae long, joints 3–11 moderately dilated, subserrate, slightly tapering outwards, densely set with short projecting hairs; prothorax transverse, small, uneven, rugose, the margins reflexed, plicate, abruptly dilated at the middle into a curved, backwardly-directed lobe, very narrowly and obliquely notched behind this, and with the inferior edge dilated into a narrow subtriangular lamella exterior to the obtuse hind angles; elytra much wider than

the prothorax, widened posteriorly; inner claw of anterior, and outer claw of the other tarsi, feebly dilated at the base.

Hab. Guatemala, Las Mercedes, Pacific slope.

The type of this species is stated to be the male from Las Mercedes figured. The other examples from the Pacific slope of Guatemala were retained by the author; those quoted by him from Cordova, San Gerónimo, and Bugaba (loc. cit. pp. 94, 296) belong elsewhere. The two males of *S. eroides* before me are opaque above, and have the black apical portion of the elytra extending angularly forwards along the suture nearly or quite to the base, and the rest of their surface, like the sides of the prothorax, ochreous. The elytra are hard and flattened, separately rounded at the tip, and faintly costate on the disc. *S. eroides* is extremely like a Lycid. It has the prothorax shaped very much as in *S. ocularis* (*cf.* fig. 94).

18. **Silis nodicollis.**

♀. *Silis nodicollis*, Gorh., Biol. Centr.-Am., Coleopt. iii, 2, p. 291 (excl. var.).

An elongate Lyciform insect, black, with the head (except at the sides), prothorax, and elytra, ochraceous and opaque, the disc of the prothorax and the anterior portion of the suture slightly infuscate. Antennae moderately long, closely pubescent, broadly dilated from the third joint, tapering outwards, joints 3–10 rounded at the inner apical angle; mandibles bent; eyes rather large; prothorax small, rugose, transversely subquadrate, the margins reflexed and angularly dilated anteriorly and bisinuate thence to the sharp hind angles; elytra elongate, much broader than the prothorax, widened posteriorly, separately rounded at the apex, with distinct smooth raised lines on the disc, the interspaces not very densely punctate.

Hab. Panama, Volcan de Chiriqui.

Gorham placed *S. nodicollis* near his *S. lycoides*, where it must remain till the male is discovered.

19. **Silis sepulchralis.** (Plate IX, fig. 83, prothorax, ♂.)

Silis sepulchralis, Gorh., Biol. Centr.-Am., Coleopt. iii, 2, pp. 293, 294 (♂ ♀).

Silis nigrita, Gorh., loc. cit. p. 93 (Quiché specimen, ♂).

♂. Eyes moderately large; antennae nearly reaching the apex of the elytra, thickly clothed with long projecting hairs; prothorax

with the lateral margins obliquely, angularly projecting in front of the very deep, narrow, sub-basal notch, the short basal lamella behind the latter hollowed in the middle, thus appearing bidentate.

♀. Eyes small; mandibles bent; antennae short, not reaching the middle of the elytra, more sparsely pilose; prothorax with the lateral margins simply trisinuate, slightly constricted in front of the sharp hind angles.

Hab. Guatemala, Totonicapam and Quiché Mts.

The types of this mountain-insect were from Totonicapam, the female being very different from the male. The Quiché male (at first placed by Gorham under *S. nigrita*) has the sides of the prothorax more broadly, and the basal lobe, testaceous, and the humeri similarly coloured. The rest of the body is deep black; the prothorax is strongly transverse in both sexes; the elytra are widened posteriorly, densely punctate, and distinctly costate.

20. **Silis nigrita.** (Plate IX, fig. 84, prothorax, ♂.)

Silis nigrita, Gorh., Biol. Centr.-Am., Coleopt. iii, 2, p. 93 (Chiacam specimens only) (*nec* p. 293).

Polemius (?) *nigritus*, Schaeff., Journ. N. York Ent. Soc. xvi, p. 62.

Moderately elongate, shining, clothed with rather long fuscous pubescence; nigro-piceous or piceous, the head down the middle and in front, the sides of the prothorax, the humeral callus, and the coxae and the base of the femora in one specimen (♂), pale testaceous. Antennae in ♂ reaching to near the apex, and in ♀ to about the middle, of the elytra. Eyes large in ♂, smaller in ♀. Prothorax (♂) rather small, transverse, bicallose on the disc behind, the margins plicate, sinuate, and reflexed, and tridentate towards the base, the backwardly-directed anterior projection separated from the others by a very narrow, oblique, deep notch, the hind angles not prominent; (♀) broader behind, with the margins trisinuate and the hind angles acute. Elytra broader than the prothorax in both sexes, somewhat widened posteriorly, roughly sculptured and obsoletely costate. Inner claw of anterior tarsi distinctly, and outer claw of the other tarsi feebly, dilated at base in ♂.

Length (excl. head) 5, breadth 2 mm. (♂ ♀.)

Hab. Guatemala, Chiacam in Alta Vera Paz, Atlantic slope.

Redescribed from the original pair from Chiacam, the ♂ being marked type. The single example of the same sex

from Quiché (described by Gorham in his diagnosis as a ? ♀ of *S. nigrita*) was subsequently referred by him (loc. cit., p. 293) to *S. sepulchralis*; and the specimens from the other localities quoted in his "Supplement" also belong to other species, *S. panamensis* and *S. fissicollis*. In the two examples seen of *S. nigrita* the testaceous coloration of the head extends angularly upwards to the vertex. Two other females from Guatemala (one acquired long ago by the British Museum, the other from Purula), both in bad condition, may belong here.

21. **Silis fissicollis**, n. sp. (Plate IX, figs. 85, 86, prothorax, ♂, ♀.)

Silis nigrita, Gorh., Biol. Centr. Am., Coleopt. iii, 2, p. 293 (part.) (*nec* p. 93).

Moderately elongate, shining, nigro-piceous or piceous, the head in front, a spot on the vertex, the sides of the prothorax broadly, the coxae, the femora to near the apex, and the tips of the tarsi, testaceous; clothed with rather long fine pubescence. Antennae (♂) long, closely set with short projecting hairs; (♀) a little shorter and more sparsely pilose. Mandibles curved in both sexes. Eyes large in ♂, smaller in ♀. Prothorax (♂) transverse, obliquely bicallose on the disc behind, and with a short carina in the intervening space, the margins plicate, sinuate, and reflexed, strongly bidentate towards the base (the two dentiform projections separated by a narrow deep notch, the anterior tooth oblique, angular, the other straight, rounded at the apex), and constricted anteriorly and immediately before the acute hind angles (fig. 85); (♀) more rounded at the sides, less narrowed in front, the margins thickened anteriorly, and constricted before the prominent hind angles (fig. 86). Elytra in ♂ about as wide as, in ♀ broader than, the prothorax, subparallel, roughly sculptured. Inner claw of anterior tarsi with a prominent angular lobe, and outer claw of the other tarsi, with a smaller lobe, in ♂.

Length (excl. head) 5–6, breadth $1\frac{1}{2}$–$1\frac{3}{4}$ mm. (♂ ♀.)

Hab. Guatemala, San Isidro and Las Mercedes, Pacific slope.

A pair from San Isidro (labelled *S. nigrita*, var., by Gorham) and two females from Las Mercedes. In the male of this insect the lateral prominences of the prothorax are more developed than in *S. nigrita* and *S. panamensis*, and the dentiform lobe of the inner anterior tarsal claw is

very conspicuous. The prothorax of the female is not widened posteriorly as in *S. nigrita*, and it is less transverse than in *S. panamensis*. The antennae of the male are densely pilose, as in *S. panamensis*. An abraded male from Calderas with the prothorax and legs darker probably belongs to the present species.

22. **Silis panamensis,** n. sp.

Silis nigrita, Gorh., Biol. Centr.-Am., Coleopt. iii, 2, p. 293 (part.) (*nec* p. 93).

Moderately elongate, shining, finely pubescent; nigro-piceous or piceous, the anterior portion of the head, the base of the mandibles, the sides of the prothorax broadly, the elytral humeri, and sometimes the femora in great part, testaceous. Mandibles abruptly bent in ♀. Eyes moderately large in ♂, smaller in ♀. Antennae (♂) as long as the body, closely pilose, joint 2 very small; (♀) much shorter, about reaching the middle of the elytra, more sparsely pilose, joint 2 stouter. Prothorax (♂) transverse, narrowed in front and behind, bicallose on the disc towards the base, somewhat rounded at the sides, the margins rather broadly explanate, and obliquely plicate at about the basal third, appearing more or less distinctly toothed in front of the fold; (♀) broader, transversely subquadrate, with the hind angles more distinct and the margins thickened towards the apex. Elytra moderately long, broader than the prothorax, somewhat widened posteriorly, roughly sculptured.

Length (excl. head) 4–4¼, breadth 1½ mm. (♂ ♀.)

Hab. Panama, Bugaba, Boquete, Volcan de Chiriqui (*Champion*).

Five males and one female, the former quoted under *S. nigrita* by Gorham and the latter left by him under *S. dilacerata*, ♀. Smaller than the Guatemalan *S. oblita*, the head differently coloured; the prothorax (♂) more feebly plicate and less distinctly dentate at the sides, that of the ♀ transversely subquadrate; the mandibles of the ♀ abruptly bent (as in *S. oblita*), instead of curved.

23. **Silis ardua.**

Silis ardua, Gorh., Biol. Centr.-Am., Coleopt. iii, 2, p. 298 (♂ ♀).

Silis paupercula, var. ?, Gorh., loc. cit. p. 299.

Moderately elongate, shining, finely pubescent; piceous or fuscous, the head in front and at the sides behind, the mandibles, the sides of the prothorax narrowly, the sutural and outer margins of the elytra, the femora to near the apex, and the intermediate and posterior tibiae in part or entirely, testaceous. Eyes very large in ♂, much smaller in ♀. Mandibles abruptly bent in ♀. Antennae rather closely pilose in both sexes, long in ♂, a little shorter in ♀, joint 2 small. Prothorax (♂) transverse, narrowed behind, the margins reflexed, plicate, and shallowly notched at the middle, the hind angles not prominent; (♀) widened posteriorly, the margins feebly sinuate and explanate to the base, the hind angles prominent. Elytra long, subparallel, wider than the prothorax, roughly sculptured.

Length (excl. head) 4½–5, breadth 1½–1⅝ mm. (♂ ♀.)

Hab. Panama, slopes of the Volcan de Chiriqui.

Redescribed from three males and six females. The mandibles of the female are incorrectly described by Gorham in his diagnosis, as "fortiter curvatis," as shown by the ♀ of *S. ardua* dissected by him and his comparative remarks on that species under *S. sicula*, the organs in question being abruptly bent, as in the same sex of the last-named insect and *S. oblita*. *S. ardua* is a little more elongate than *S. oblita*; the antennae are infuscate, or have at most the apical joint paler; and the prothorax has the lateral margins, and the elytra the sutural and outer margins, testaceous.

24. Silis bugabensis.

♀. *Silis bugabensis*, and var. *apicipennis*, Pic, Mélanges exot.-entom. fasc. v, pp. 4, 5 (March 1913).

Silis lineata, Gorh., Biol. Centr.-Am., Coleopt. iii, 2, p. 296 (*nec* p. 95).

Silis lineola, Gorh., loc. cit. p. 296 (part.) (Panama specimen).

Moderately elongate, rather shining, somewhat thickly pubescent, the pubescence ochreous on the flavous portions of the surface; nigro-piceous or black, the antennae with from 1–4 of the outer joints, the head and prothorax (a broad continuous median vitta excepted), the elytra (except the suture to a greater or less extent, and often the apical half also [var. *apicipennis*]), and usually the base of the femora, flavo-testaceous. Eyes large in ♂, smaller in ♀. Antennae slender and nearly reaching the apex of the elytra in ♂, shorter in ♀. Prothorax (♂) a little broader than long, rather

narrow, bicallose on the disc posteriorly, the margins somewhat rounded, plicate, narrowly notched behind the middle, dilated before and behind this into a moderately prominent dentiform projection, and constricted in front of the acute hind angles; (♀) subquadrate, with the margins angularly dilated and thickened anteriorly, and sinuate thence to the acute hind angles. Elytra long, wider than the prothorax, parallel or widened posteriorly, flattened on the disc, roughly sculptured and costulate.

Length (excl. head) 4⅕–6½, breadth 1½–2½ mm. (♂ ♀.)

Hab. Panama, Chiriqui.

Separable from the Mexican and Guatemalan *S. lineata* (= *lineola*) by the less orbicular prothorax, with the two dentiform lateral projections more feebly developed, in the male, and by the yellow tip to the antennae in both sexes. The thirteen examples in the "Biologia" collection vary greatly in the colour of the elytra, more than half of them belonging to the var. *apicipennis*, one having the elytra almost entirely testaceous. Pic, to judge from his description of the prothorax, had females only before him. *S. bugabensis* has the general facies of certain species of the Hispid genus *Chalepus*.

25. **Silis lineata.** (Plate IX, fig. 87, prothorax, ♂.)

Silis lineata, Gorh., Biol. Centr.-Am., Coleopt. iii, 2, p. 95 (♂ ♀) (*nec* p. 296) [nec *S. lineatus*, Gorh., Ann. Soc. Ent. Belg. 1895, p. 315].

Silis lineola, Gorh., loc. cit. p. 296 (♂) (exclud. Panama specimen).

Polemius (?) *lineola*, Schaeff., Journ. N. York Ent. Soc. xvi, p. 62.

Moderately elongate, shining, sparsely pubescent; nigro-piceous, the head and prothorax (a continuous median vitta excepted), the basal third half, or more of the elytra (except along the suture), or the humeri only in some of the Guatemalan specimens, and the basal half or more of the femora, flavo-testaceous. Eyes very large in ♂, smaller in ♀. Antennae sparsely pilose, long in ♂, shorter in ♀. Prothorax (♂) much narrowed anteriorly and strongly constricted before the base (the general outline thus appearing suborbicular, as described by Gorham), the margins dilated into two prominent teeth, which are separated by a deep median notch, the hind angles also acute and prominent; (♀) broader, transversely subquadrate, the margins hollowed at the middle and thickened and angularly

dilated anteriorly, the hind angles prominent. Elytra subparallel, roughly sculptured and distinctly costate. Inner claw of anterior tarsi, and outer claw of the other tarsi, angularly dilated at base.

Length (excl. head) $4\frac{1}{4}$–$5\frac{1}{2}$, breadth $1\frac{1}{3}$–$1\frac{4}{5}$ mm. (♂ ♀.)

Hab. Mexico, Jalapa, Atoyac, Teapa; Guatemala, Alta Vera Paz.

Gorham (loc. cit. p. 297) states that *S. lineola* is perhaps not quite satisfactorily distinguished from *S. lineata*; there is, in fact, no difference between them, the specimens of the latter (from Cahabon) labelled by him as types are females and those of *S. lineola* (from Chiacam) are males. The Chiriqui examples mentioned, however, in each case, belong to a different species, *S. bugabensis*, Pic. The flavo-testaceous coloration of the elytra often extends to beyond the middle, leaving the suture and apex nigro-piceous, a long series (♂ ♀) captured by Höge and H. H. Smith at Teapa being thus coloured. The author's remarks on the typical male of *S. lineata* apply to the Chiriqui specimens added in the "Supplement" (loc. cit. p. 297) = *S. bugabensis*, Pic.

26. **Silis oblita.** (Plate IX, fig. 88, prothorax, ♂.)

Silis oblita, Gorh., Biol. Centr.-Am., Coleopt. iii, 2, p. 297.
Silis paupercula, Gorh., loc. cit. p. 299 (specim. from Vera Paz).

Moderately elongate, shining, clothed with long pallid pubescence; fuscous or piceous, the points of insertion of the antennae, and usually from 3–5 of the outer joints of the latter, the mandibles, the post-ocular portions of the head, the prothorax (a median vitta or triangular patch on the disc excepted), the elytra usually with the humeri or the sutural and outer margins, and the legs in great part, or the femora at the base, pale testaceous. Eyes very large in ♂, smaller in ♀. Antennae slender, long in ♂, shorter in ♀. Mandibles curved in ♂, abruptly bent in ♀. Prothorax (♂) transverse, constricted before the base and apex (thus appearing rounded at the sides), the margins plicate, reflexed, and feebly notched, the base sinuate, the hind angles sharp; (♀) more transverse, broader behind, the margins trisinuate, the hind angles more prominent. Elytra moderately long, subparallel, broader in ♀, roughly sculptured. Inner claw of anterior tarsi, and outer claw of the other tarsi, feebly widened at base in ♂.

Length (excl. head) 4–$5\frac{3}{4}$, breadth $1\frac{1}{5}$–$2\frac{1}{10}$ mm. (♂ ♀.)

Hab. Mexico, Jalapa, Tapachula; Guatemala, San Juan in Alta Vera Paz, Zapote, Cerro Zunil; Costa Rica, Irazu; Panama, Volcan de Chiriqui [types], Boquete, Bugaba.

A widely distributed variable insect, occurring on both the Atlantic and Pacific slopes. It may be separated from *S. ardua* (at least in the typical form) by the narrowly fusco-vittate prothorax, which is more rounded at the sides and more constricted before the base in the male, and the pale apical joints to the antennae; and from *Polemius pauperculus* by the abruptly bent mandibles of the female and the differently shaped prothorax of the male. In *S. oblita* the antennae and elytra are variable in colour, being sometimes wholly fuscous or piceous, and the prothorax is occasionally immaculate. Gorham's description is contradictory as it stands: the mandibles of the female are said to be strongly curved in the diagnosis and bent in the general description; the male labelled by him as type has the sutural and elytral margins testaceous, of which nothing is said in the description. The types were from Chiriqui, the examples from the more northern localities not being quoted. Thirty-eight specimens are before me, including many males. Two of the three females from Cerro Zunil, those with immaculate prothorax and dark antennae, were enumerated by him under *S. pauxilla*, an insect here referred to the genus *Discodon*.

27. **Silis scabripennis,** n. sp. (Plate IX, fig. 89, prothorax, ♂.)

Moderately elongate, shining, finely pubescent; black, the anterior portion of the head, the mandibles, and prothorax testaceous or flavo-testaceous. Eyes very large in ♂, a little smaller in ♀. Antennae long and slender, slightly shorter in ♀. Prothorax (♂) small, much broader than long, rounded at the sides, constricted anteriorly and before the base, the margins reflexed, plicate, and very narrowly, obliquely excised behind the middle (the margin in front of the notch acute or toothed and the portion posterior to it triangular), the hind angles obtuse; (♀) broader, less narrowed behind, the margin sinuate, thickened, and subangularly dilated anteriorly, the hind angles acute and prominent. Elytra wider than the prothorax, moderately long, subparallel, roughly sculptured and faintly costate. Inner claw of anterior tarsi angularly, and outer claw of the other tarsi more feebly, dilated at base in ♂.

Length (excl. head) $4\frac{1}{2}$–$4\frac{3}{4}$, breadth $1\frac{1}{2}$ mm. (♂ ♀.)

Hab. Mexico (*Truqui, ex coll. Fry*).

Two males and one female. Very like *Discodon melanaspis*, but with the front of the head testaceous, the eyes much larger in both sexes, the prothorax of the male smaller, shorter, and rounded and narrowly incised at the sides (much as in *S. oblita* and its allies), and the tarsal claws uncleft at the tip.

28. **Silis haematodes.** (Plate IX, fig. 90, prothorax, ♂.)

Silis haematodes, Gorh., Biol. Centr.-Am., Coleopt. iii, 2, pp. 93, 294 (♂ ♀).

Hab. Guatemala, Pacific slope.

The types of this species, from Capetillo (1 ♂ and 3 ♀♀), are very shining and sparsely pilose, and have unusually coarsely, somewhat sparsely punctured, wholly black elytra; the others before me (♂ ♀), from various localities, have more densely punctate, nigro-piceous elytra, with the humeri in some of them testaceous, the base of the femora being also of that colour in three examples. The eyes are moderately large in ♂, smaller in ♀. The prothorax in both sexes is strongly transverse, and has a broad reflexed margin; that of the male has a narrow deep notch at about the basal third, preceded by a sinuous very prominent tooth and followed by a smaller straight tooth; that of the female is broader, with the margins strongly trisinuate and the hind angles acute. The inner claw of the anterior tarsi, and the outer claw of the middle tarsi, have an angular tooth at the base in the male.

29. **Silis melanocephala.** (Plate IX, fig. 91, prothorax, ♂.)

Silis melanocephala, Gorh., Biol. Centr.-Am., Coleopt. iii, 2, p. 294 (♂).

Hab. Guatemala, Capetillo.

This species is based upon a single male example. It is a form of, and perhaps not really distinct from, *S. haematodes*, which occurred at the same locality, with still longer antennae, a black head and scutellum, and the tooth in front of the lateral notch of the prothorax not curved outwards. According to Gorham the notch is placed nearer the hind angle than in *S. haematodes*, but this is not obvious.*

* He also compares *S. melanocephala* with *S. atripennis* (? *erythroderes*), a nomen nudum.

30. **Silis transfixa.** (Plate IX, fig. 92, prothorax, ♂.)

Silis transfixa, Gorh., Biol. Centr.-Am., Coleopt. iii, 2, p. 295.
Polemius (?) *transfixus*, Schaeff., Journ. N. York Ent. Soc. xvi, p. 62.

Hab. Panama, Volcan de Chiriqui.

Recognisable by the rufo-testaceous head, palpi, antennae, prothorax, and scutellum, and black elytra, the legs partly or almost entirely infuscate, the anterior femora at the base and the tibiae and tarsi at most testaceous. Eyes extremely large in ♂, smaller in ♀. Mandibles curved in both sexes. Antennae slender. Prothorax of the male plicate and angularly dilated at the sides, with a slender outwardly-curved tooth in front of the very narrow, oblique, deep, post-median notch; that of the female angularly dilated at the sides beyond the middle and with the hind angles acute, the margins thus appearing strongly trisinuate. Represented in the "Biologia" collection by two males and one female.

31. **Silis fulvipes.** (Plate IX, fig. 93, prothorax, ♂.)

Silis fulvipes, Gorh., Biol. Centr.-Am., Coleopt. iii, 2, p. 295.
Polemius (?) *fulvipes*, Schaeff., Journ. N. York Ent. Soc. xvi, p. 62.

Hab. Panama, Volcan de Chiriqui, 4000–6000 ft.

An elongate, narrow, finely pubescent insect, with testaceous head, palpi, antennae, prothorax, scutellum, and legs, and plumbeous elytra; the eyes large (♂); the prothorax (♂) rounded at the sides, the reflexed margin with a very narrow, straight notch behind the middle, thus appearing angulate in front of the excision; the elytra finely sculptured; the eighth dorsal segment (= pygidium of Gorham) (♂) divided into two long narrow lobes. The less angulate, more sharply notched sides of the prothorax, and the smaller eyes, etc., of the male separate *S. fulvipes* from *S. transfixa*. The nine examples placed by Gorham under the present species are all of this sex, but a single female left by him under *S. transfixa* probably belongs here: it has the intermediate joints of the antennae and the femora infuscate, the mandibles bent (instead of curved), the margins of the prothorax thickened,

rounded and very feebly sinuate, and the hind angles prominent.

32. **Silis ocularis.** (Plate IX, fig. 94, prothorax, ♂.)

Silis ocularis, Gorh., Biol. Centr.-Am., Coleopt. iii, 2, p. 293 (♂).

Hab. Guatemala, El Reposo and Paraiso, Pacific slope.

In this species, based upon two males, the eyes are very large; the antennae are about as long as the body, slender, and closely pilose; the prothorax is very short and broad, the lateral margins explanate, plicate, and with a very deep, narrow, oblique notch behind the middle, the dilated space in front of it appearing broadly hooked; the elytra are piceous, like the basal portion of the head, shining, and comparatively short, the anterior portion of the latter, the prothorax, scutellum, and femora (the tip excepted) testaceous. Length (excl. head) 3–3½ mm.

33. **Silis appendicularis.** (Plate IX, fig. 95, prothorax, ♂.)

Silis appendicularis, Gorh., Biol. Centr.-Am., Coleopt. iii, 2, p. 304 (♂ ♀).

Hab. Panama, Volcan de Chiriqui, above 4000 ft.

A small, shining, sparsely pubescent insect, with the anterior portion of the head, the mandibles, and prothorax rufous or rufo-testaceous, the head and prothorax almost smooth, and the elytra roughly sculptured. The prothorax has the narrowly reflexed margins abruptly and strongly dilated posteriorly in both sexes, the dilated portion deeply, narrowly incised in the male (a curved backwardly-directed lobe being thus formed in front of it) and feebly emarginate in the female. The tarsi have one of the claws lobed at the base in the male. The mandibles are curved in the female. One male and three females seen.

34. **Silis aurita.** (Plate IX, fig. 96, prothorax, ♀.)

♀. *Silis aurita*, Gorh., Biol. Centr.-Am., Coleopt. iii, 2, p. 295.

Hab. Costa Rica, Irazu.

The type of *S. aurita* (♀) superficially resembles *S. haematodes* and *S. erythroderes*, Gorh., *i. e.* it is a shining black insect, with a red head, prothorax, and scutellum.

The general shape of the prothorax, however, approaches that of the same sex of *S. appendicularis*, it being small, strongly transverse, much narrowed anteriorly, and dilated into a prominent thickened blunt tooth at some little distance before the obtuse hind angle. The two other specimens (♀), from the same locality, doubtfully referred by Gorham to *S. aurita*, probably belong to his *S. pauxilla*, a variable insect ranging from Vera Paz to Chiriqui, and (like *S. erythroderes*) here placed under *Discodon*.

35. **Silis chalybeipennis.** (Plate IX, fig. 97, prothorax, ♂.)

Silis chalybeipennis, Gorh., Biol. Centr.-Am., Coleopt. iii, 2, p. 300, pl. 12, fig. 18 (♀).

Hab. Panama, Volcan de Chiriqui, 4000–8000 ft.

Recognisable by the testaceous head, antennae, palpi, prothorax, and scutellum, the metallic blue elytra, and the black under surface and legs. The prothorax has a very deep abrupt notch in front of the acute, dentiform hind angles in each sex, and the broadly explanate lateral margins are also hollowed or constricted behind the middle, this being more noticeable in the female than in the male. The inner claw of the anterior tarsi, and the outer claw of the intermediate tarsi, are dilated at the base in the male. Six examples seen. *S. chalybeipennis* should perhaps form the type of a new genus.

The following species cannot be definitely placed till the males are found.

36. **Silis sicula.**

Silis sicula, Gorh., Biol. Centr.-Am., Coleopt. iii, 2, p. 298 (♀).

Hab. Guatemala, Purula in Vera Paz.

This species, described from two females (one now without antennae), may be known, at least in ♀, by its rather coarsely, densely, subseriately punctate elytra; the small, strongly transverse prothorax, with testaceous disc and nigro-piceous margins, and the lateral margins sinuate and reflexed; the rather stout, tapering antennae; and the abruptly bent mandibles. *S. sicula* will probably prove to belong to *Polemius* as here understood.

37. **Silis omiltemia,** n. sp.

♀. Elongate, rather shining, black, the mandibles and prothorax (a narrow median vitta and the outer and anterior margins excepted) rufo-testaceous; somewhat thickly clothed (the antennae included) with fuscous pubescence, the hairs on the rufescent portion of the prothorax yellowish. Head broad; mandibles stout, abruptly bent; antennae rather slender, subfiliform, about reaching the basal third of the elytra. Prothorax short, strongly transverse, depressed down the middle behind, somewhat dilated posteriorly, the margins rather broadly explanate, reflexed, sinuate, and constricted at the base, the hind angles prominent. Elytra very elongate, wider than the prothorax, sinuate at the sides (perhaps due to shrinkage after death), rather roughly sculptured and obsoletely costate.

Length (excl. head) 7, breadth $2\frac{1}{2}$ mm.

Hab. Mexico, Omilteme in Guerrero, 8000 ft. (*H. H. Smith*).

One example. Larger and broader than the Guatemalan *S. sicula*, Gorh.; the mandibles bent as in the female of that species, but stouter; the elytral sculpture not nearly so coarse and more confused; the antennae subfiliform. The prothorax is very short and has a dark reflexed margin as in *S. sicula*, a median vitta, however, being present in *S. omiltemia*. Till the male is discovered the Guerrero insect is perhaps best placed under *Silis*.

38. **Silis lissoderes,** n. sp.

♀. Moderately elongate, shining, fusco-pubescent; black, the front of the head, the mandibles, and the sides of the prothorax broadly (leaving a basally and apically dilated broad black patch on the disc), testaceous. Eyes small. Mandibles abruptly bent. Antennae rather slender, short, barely reaching the basal third of the elytra, pilose. Prothorax short, strongly transverse, gradually narrowed anteriorly, the margins moderately explanate, thickened, and constricted in front of the acute hind angles, the surface almost smooth. Elytra moderately long, wider than the prothorax, parallel, densely, rather finely sculptured and obsoletely costate.

Length (excl. head) $4\frac{3}{4}$–5, breadth $1\frac{1}{2}$ mm.

Hab. Mexico, Cuernavaca in Morelos (*H. H. Smith*).

Two females. This insect seems to be allied to *S. sepulchralis*, Gorh., from the Guatemalan mountains, differing from the corresponding sex of that species in the

broader and much smoother head, with the anterior portion testaceous, the almost smooth prothorax, with more thickened margins, the parallel elytra, and the less thickened antennae.

Ditemnomorphus, n. gen.

Tarsi each with one claw cleft at tip in ♂; prothorax with the lateral margins bi-incised, and strongly bilamellate and unispinose in ♂, deeply notched at base in ♀; the other characters as in the section *Ditemnus* of *Silis*.

Type, *Silis rufifrons*, Gorh.

1. **Ditemnomorphus rufifrons.** (Plate IX, figs. 98, ♂, 99 ♀, prothorax.)

Silis rufifrons, Gorh., Biol. Centr.-Am., Coleopt. iii, 2, p. 97 (♂ ♀).

Hab. Guatemala, Chiacam in Alta Vera Paz.

One male and three females of this species are available for examination. The prothorax of the male has two long, backwardly-directed lobes on each side, the posterior lobe narrow, hooked at the tip, and armed at the base above with a still longer, slender, acute, oblique spine; that of the female has a deep oblique notch in front of the acute hind angles. The head, prothorax, and scutellum are rufo-testaceous, and the rest of the surface is piceous or black. The mandibles are bent in the female.

Parasilis.

Parasilis, Gorham, Biol. Centr.-Am., Coleopt. iii, 2, p. 307 (1885).

This genus is based upon two allied forms from Chiriqui, Panama. The diagnosis and remarks on the structural characters must have been taken from the females of *P. colyphoides* (the specimens marked " ? male " by Gorham being also of that sex); there are, however, five males in the " Biologia " series before me. The males of both species have one of the tarsal claws of each foot cleft, the sides of the prothorax obliquely plicate and angularly notched at the middle, the eyes a little larger and more prominent than in the female, and the last ventral segment divided to the base. The very slender filiform antennae, with elongate second joint, the coarsely punctured, parallel-

sided, firm elytra, and the above-mentioned characters of the male, separate *Parasilis* from the allied genera. The terminal joint of both palpi is long, stout, and securiform in each sex. The genital armature is symmetric. There is an unnamed species of *Parasilis* from Ecuador in the British Museum.

1. Parasilis colyphoides. (Plate III, fig. 12, ♂.)

Parasilis colyphoides, Gorh., Biol. Centr.-Am., Coleopt. iii, 2, p. 308.

♂. Eyes moderately large, prominent; prothorax as long as broad, narrow, deeply transversely excavate across the disc anteriorly and hollowed down the middle thence to the base, arcuate in front, the margins obliquely plicate and angularly notched at the middle, dilated into a blunt tooth in front of this, and reflexed and slightly sinuate thence to the apex, the space between the notch and the base rounded, convex, and almost immarginate; tibiae somewhat curved; inner claw of anterior tarsi, and outer claw of the other tarsi, cleft at the tip; seventh ventral segment long, divided into two lobes; last dorsal segment drawn out into a long, curved, attenuate lobe on each side, the two lobes meeting at the tip and extending far beyond the seventh ventral segment.

♀. Eyes smaller; prothorax a little shorter, the excavations shallower, the margins somewhat rounded, feebly trisinuate, and reflexed throughout; sixth ventral segment shorter, triangularly emarginate in the middle at the apex.

Hab. Panama, Volcan de Chiriqui.

Twenty-two specimens seen, five of which are males, one of the latter with an oblique pallid stripe on each elytron. The appendages of the last dorsal segment of the male form a pair of forceps, a somewhat similar structure having been noticed by Gorham in the same sex of *P. vittata*. The terminal segments of the abdomen and the evaginated genital armature are figured on Plate VI, figs. 37, 37*a*.

2. Parasilis vittata.

Parasilis vittata, Gorh., Biol. Centr.-Am., Coleopt. iii, 2, p. 308.

♂. Eyes a little larger than in ♀; prothorax as long as broad, the margins obliquely plicate and angularly notched at the middle,

dilated into a blunt tooth in front of this, and rounded, convex, and almost immarginate from the notch to the base; tibiae curved; tarsal claws as in *P. colyphoides*.

♀. Prothorax smaller and shorter, rounded and feebly bisinuate at the sides, the margins narrowly reflexed throughout.

Hab. Panama, Bugaba, Volcan de Chiriqui.

Redescribed from the types, male and female. Smaller than *P. colyphoides*, the legs more slender, the head between and behind the eyes, the prothorax across the middle, and the apices of the femora, tibiae, and tarsi piceous or black; the elytra coarsely punctate, piceous or nigro-piceous, with an oblique stripe running down the disc, and the outer margin and apex also in the male, testaceous. The tip of the abdomen of the male is injured, but the last dorsal segment appears to be drawn out in a lobe on each side beneath (as described by Gorham), much as in *P. colyphoides*.

Malthaster.

Malthaster, Gorham, Biol. Centr.-Am., Coleopt. iii, 2, p. 311 (1885).

This genus is based upon a single species, *M. suturalis*, from the mountains of Chiriqui. To the characters given by the author, the following may be added:—Prothorax obliquely grooved on each side before the middle, the margins triangularly notched in ♂ and sinuate in ♀ (as in *Parasilis*, etc.). The tarsal claws and mandibles are simple. The elytra are very long, soft, and completely cover the wings and abdomen. The cleft seventh * ventral segment and the notched margins of the prothorax of the male bring *Malthaster* near *Parasilis*, *Discodon*, *Polemius*, etc.

1. **Malthaster suturalis.** (Plate III, fig. 13, ♀.)

Malthaster suturalis, Gorh., Biol. Centr.-Am., Coleopt. iii, 2, p. 311.

Hab. Panama, Volcan de Chiriqui, 8000 ft.

The symmetrical genital armature of the male is figured on Plate VI, figs. 38, 38*a*, *b*, and the prothorax of a specimen of this sex on Plate IX, fig. 100.

* Described by Gorham as the sixth.

Group Ichthyurini.

This group may be characterised thus :—Apical joint of the maxillary and labial palpi stout, securiform or cultriform; prothorax subquadrate, entire; elytra greatly abbreviated, leaving the wings in large part exposed; abdominal segments 1–8 each with a small circular orifice at or beneath the outer apical angle (*Ichthyurus*, etc.), the orifice in 1–7 sometimes placed at the tip of an oblique tubuliform process arising from the space between the two surfaces (*Maronius* and *Belotus*), 8 forcipiform or bilobed in one or both sexes; genital armature asymmetric; tarsal claws lobed or toothed at base, or simple, uncleft at tip.

The following known genera belong here :—*Ichthyurus*, *Trypherus*, *Lobetus*, *Maronius*, and *Belotus*. The circular orifice at or near the tip of each process of the chitinous eighth dorsal segment of the abdomen is conspicuous in all these insects, but that on each side of the preceding segments (except in *Maronius* and *Belotus*) is often hidden beneath the lateral fold in dried specimens. The genital armature of *Maronius* and *Belotus* is very similar to that of the *Chauliognathinae*.

Ichthyurus.

Ichthyurus, Westwood, Cabinet Orient. Ent. p. 83 (1848); Lacordaire, Gen. Coleopt. iv, p. 361.
Biurus, Motschulsky, Études Ent. i, p. 13 (1853).
Diurus, Gemminger et Harold, Cat. Coleopt. vi, p. 1684 (1869).

Various Eastern *Ichthyuri* are now known with the femora and tibiae simple in the two sexes, as in certain Tropical American forms, and these latter cannot therefore be separated from Westwood's genus. The stout, vertical head, the very large, oval or reniform, somewhat narrowly separated eyes (as seen from in front), between which the antennae are inserted close together, the forcipiform or bilobate eighth dorsal segment of the abdomen (usually differing greatly in form in the two sexes), and the feebly-developed asymmetric genital armature of the males, are characteristic. *Lobetus mirabilis*, Gorh., from Mexico, its extraordinary ♂ antennae and maxillary palpi notwithstanding, must be provisionally included in *Ichthyurus*, the general structure of the head, abdomen, etc., agreeing

perfectly with that of the present genus, and differing greatly from that of *Lobetus*, Kies., type *L. torticornis*, from Colombia. *Trypherus*, Lec., type *Malthinus latipennis*, Germ., from N. America, two females of which are available for comparison, has a broader, flatter, basally narrowed head, more widely separated eyes, and a less developed terminal segment to the abdomen.* Amongst the seven Mexican or Central American *Ichthyuri* before me, five are represented by females only. Males of the E. African *I. forcipiger*, Gestro (= *apicalis*, Motsch.), and the Mexican *I. dichelifer* have been dissected for comparison, and they prove to be very closely related. *Malthinus* (*Biurus*) *elegans*, Guér., from Brazil, is obviously an *Ichthyurus*, ♀.

1. **Ichthyurus dichelifer,** n. sp. (Plate III, figs. 14, 14*a*, ♀.)

Nigro-piceous or piceous, the base of the antennae, the basal half or more of the femora, the margins of the abdomen, and the abdominal forceps in part, flavous or testaceous; the prothorax and elytra yellow, the prothorax with a small oval spot on the disc and a curved streak on each side of it, the latter often with a ramus extending outwards, and the elytral suture rather broadly, piceous. Head (fig. 14*a*) almost smooth, hollowed between the eyes above, the latter very large in ♂, a little smaller in ♀; antennae (♂ ♀) slender, about reaching the apex of the elytra, joint 2 one-half the length of 3. Prothorax transverse, arcuate in front, the basal and apical margins reflexed; closely, minutely punctate, the disc arcuately depressed towards the base, and usually with a small oblong tubercle in the centre of the depression. Elytra about twice the length of the prothorax hollowed on their outer margin and dehiscent from a little below the base, finely punctate, obliquely grooved below the humeri and subcostate on the disc.

♂. Terminal abdominal segment, dorsal and ventral, produced on each side into a long, stout, somewhat curved, chitinous process, the processes of the dorsal segment very stout, subconical, convex above, and mucronate at the tip inferiorly, that of the ventral segment shorter, narrower, and curved upwards (the two on each side, as seen laterally, forming a pair of forceps); a long narrow median rod, terminating in two slender, straight laciniae, protruding between the two pairs of forceps (Plate VI, figs. 39, 39*a*); the two segments preceding the terminal one somewhat elongated, and rounded externally.

* Numerous S. American species have recently been described by Pic under *Trypherus*.

♀. Terminal dorsal abdominal segment only produced on each side into a long, flattened, subtriangular process (Plate III, fig. 14). Length 7–8 mm. (♂ ♀.)

Hab. Mexico, Chilpancingo in Guerrero (*Höge, H. H. Smith*).

Nine males and eight females, the males readily distinguishable by the double pair of abdominal forceps.

2. Ichthyurus forficulinus.

♀. *Trypherus forficulinus*, Gorh., Biol. Centr.-Am., Coleopt. iii, 2, p. 98, pl. 6, fig. 7.

Hab. Guatemala, Quiché Mts.

The unique type of this species is a female. There is a very similar form, ♀, from Sarayacu, Peru, in the British Museum, too imperfect to describe.

3. Ichthyurus trimaculatus.

Trypherus trimaculatus, Pic, Mélanges exot.-entom., fasc. xi, p. 9 (Nov. 1914).

" Grandis, elongatus, fere opacus, niger, infra corpore pro majore parte, capite antice, luteo-testaceis, thorace luteo-testaceo, in disco nigro trimaculato (macula mediana minuta, externis arcuatis), elytris nigris, apice late luteo-testaceo notatis. Long. 10–11 mill." Diffère, à première vue, de *T. forficulinus*, Gorh., par le prothorax orné de 3 macules noires.

Hab. Mexico, Jalapa (*coll. Pic*).

Apparently a close ally of the Guatemalan *I. forficulinus*, and evidently belonging to the same genus. Included by Pic amongst the species placed under the heading " Descriptions abrégées," the sex, etc., not being mentioned.

4. Ichthyurus fuscus.

♀. *Belotus fuscus*, Gorh., Biol. Centr.-Am., Coleopt. iii, 2, p. 99 (excl. var.).

Hab. Mexico, Yolos in Oaxaca.

Represented in the " Biologia " collection by three imperfect females; the so-called variety from the same locality is a dark male of *Belotus abdominalis*. In these examples the yellow apical patch on the elytra extends forwards along the outer margin to near the humeri, the

rest of the body being piceous or nigro-piceous (the lateral margins of the first three or four abdominal segments excepted), and the legs and antennae are also infuscate. The terminal processes of the last dorsal segment are long and subconical, longer than in *I. sallei* and *I. fusciventris.*

5. **Ichthyurus fusciventris,** n. sp.

♀. Moderately elongate, shining, finely pubescent; nigro-piceous, the apices of the elytra broadly yellow, the two basal joints of the antennae and the base of the femora testaceous. Head minutely punctate, transversely depressed between the eyes above, the latter large; antennae slender, about reaching the apices of the elytra. Prothorax transverse, minutely punctate, and with a very small, smooth, oblong tubercle on the middle of the disc. Elytra nearly twice the length of the prothorax, obliquely plicate, and closely punctate. Terminal dorsal segment of the abdomen produced on each side into a triangular process.

Length $3\frac{1}{6}$ mm.

Hab. Mexico, Chilpancingo in Guerrero (*H. H. Smith*).

Two females. A small form near *I. semiflavus,* with the apices only of the elytra yellow, the prothorax and abdomen infuscate, the abdominal appendages flatter. The small tubercle on the prothorax is similar to that present in *I. semiflavus* and *I. dichelifer.* Compared with *I. fuscus,* Gorh., ♀, the present species is much smaller and has the yellow portion of the elytra restricted to the apex and the terminal processes much shorter.

6. **Ichthyurus semiflavus,** n. sp.

♀. Moderately elongate, shining, finely pubescent; piceous, the elytra with an obliquely cut-off outer space yellow (leaving a very large, subtriangular, common, dark scutellar patch), the head between the eyes, the basal joints of the antennae, some irregular sinuous markings on the prothorax, the terminal dorsal abdominal segment (except at the tip), and the base of the femora, testaceous or flavous. Head minutely punctate, broadly depressed between the eyes above, the latter large; antennae moderately slender. Prothorax transverse, closely, minutely punctate, arcuately depressed on the disc towards the base, and with a small, smooth, oblong tubercle in the middle of the depression. Elytra about twice as long as the prothorax, closely punctate and distinctly

costate. Terminal dorsal segment of the abdomen produced on each side into a rather broad subconical process. Legs stout.

Length $4\frac{1}{3}$ mm.

Hab. Guatemala, near the city, 5000 ft. (*Salvin*).

One specimen, found placed under *Belotus abdominalis* in the "Biologia" collection. Smaller and less elongate than *I. dichelifer*, ♀, the fuscous portion of the elytra extending outwards to the humeri, the subconical processes of the last dorsal segment much shorter. Three smaller immature females with the prothorax wholly flavous, from Capetillo and Dueñas, must also belong to the same species. Allied S. American unnamed forms are contained in the Fry collection at the British Museum.

7. Ichthyurus sallei.

Trypherus sallei, Pic, Mélanges exot.-entom., fasc. vii, p. 19 (Sept. 1913).

"Elongatus, nitidus, griseo-pubescens, nigro-piceus, elytris brunnescentibus, capite antice, antennis ad basin pedibusque pallidis. Long. 5 mill. 5."

Hab. Mexico, Cordova and Toxpam (*Sallé*), Atoyac (*H. H. Smith*).

Three females seen, two of which were found placed as a variety of *Belotus abdominalis* in the "Biologia" collection. These have the head and prothorax reddish or rufo-piceous and paler than the elytra, the apical margin of the latter being yellowish in one of them, and the tibiae more or less infuscate in their outer half; the upper surface closely, very minutely punctate; and the produced lateral portions of the terminal dorsal segment of the abdomen triangular, much as in the same sex of *I.* (*Lobetus*) *mirabilis*, Gorh.

8. Ichthyurus mirabilis.

Lobetus mirabilis, Gorh., Biol. Centr.-Am., Coleopt. iii, 2, p. 99, pl. 6, figs. 10 (♂), 11 (♀).

Hab. Mexico, Cordova, Toxpam.

Described by Gorham from two males and two females, and now represented in the "Biologia" collection by a dissected ♂ and the abdomen and hind legs of a ♀. The extraordinary antennae of the male were noticed and figured by him; but he does not mention the equally

peculiar structure of the maxillary palpi, the third joint in this sex being produced on the inner side into a very long slender straight process, which is nearly as long as the stouter, sinuous, outwardly-directed fourth joint (Plate IX, fig. 101).

Maronius.

Maronius, Gorham, Biol. Centr.-Am., Coleopt. iii, 2, pp. 100 (1881), 309 (1885).

The type of this genus is *M. dichrous*, and various other Tropical American forms have been described by Pic. Its chief characters are the short, broad, posteriorly constricted head, the large eyes, the securiform apical joint of the palpi, the simple antennae and tarsal claws, the toothed mandibles, the quadrate prothorax, the greatly abbreviated elytra, the broad, bilobate penultimate dorsal segment of the abdomen, and the greatly developed asymmetric genital lobes of the male, these being covered ventrally by an oval convex cap. The species are larger and more robust than those of the closely allied genus *Belotus*. In both these genera segments 1–7 of the abdomen have an oblique tubuliform process on each side arising from the space between the two surfaces and a circular orifice at the tip of the conical lateral protuberance of the penultimate dorsal segment, see Plate III, fig. 15. The males have the terminal segment broad and somewhat twisted, so that a portion of the ventral aedeagal cap is often visible from above.

1. **Maronius dichrous.**

Maronius dichrous, Gorh., Biol. Centr.-Am., Coleopt. iii, 2, p. 100, pl. 6, fig. 9 (♂).

Hab. Mexico; Guatemala; Nicaragua.

The specimens from Chiriqui added by Gorham in his "Supplement," p. 309, must be separated. The genital armature of *M. dichrous* is figured on Plate VII, figs. 40, 40*a*, and the ♂ abdomen on Plate III, fig. 15.

2. **Maronius longicollis,** n. sp.

Maronius dichrous, var., Gorh., loc. cit. p. 309, pl. 12, fig. 17 (♀).

Very like *M. dichrous*, but with the prothorax, except at the anterior or hind angles, or along the sides posteriorly, infuscate or

black, the prothorax itself less transverse, the securiform apical joint of the maxillary palpi broader in both sexes, the terminal dorsal segment of the abdomen of the male larger, and the genital armature very different, see Plate VII, figs. 41, 41*a*.

Hab. Panama, Chiriqui.
Two males and two females seen.

Belotus.

Belotus, Gorham, Biol. Centr.-Am., Coleopt. iii, 2, pp. 99 (1881), 308 (1885) (sine descr.).
Lobetus, Leconte, Trans. Am. Ent. Soc. ix, pp. 58, 59 (*nec* Kiesenwetter).

The type of this genus is *Malthinus abdominalis*, Lec., a species ranging from the Southern United States to Panama and perhaps further southward, and various other allied Tropical American forms belong here. Its principal characters are the simple antennae and tarsal claws, the toothed mandibles, the stout subsecuriform apical joint of the palpi, the greatly abbreviated elytra, the emarginate penultimate dorsal segment of the abdomen, the subquadrate prothorax, the moderately developed head, and the asymmetric genital armature, the various lobes covered ventrally by an oval convex cap, as in *Chauliognathus*. In two of the species the penultimate dorsal segment of the abdomen is formed much as in the females of various *Ichthyuri*. Pic has described several species of *Belotus* from South America.

1. Belotus abdominalis.

Malthinus abdominalis, Lec., Proc. Acad. Phil. v, p. 347 (1851).
Lobetus abdominalis, Lec., Trans. Am. Ent. Soc. ix, p. 59.
Belotus abdominalis, Gorh., Biol. Centr.-Am., Coleopt. iii, 2, pp. 99, 308, pl. 6, fig. 8 (♀) (part.).
Belotus fuscus, var., Gorh., loc. cit.
Belotus abdominalis, var. *obscurior*, Pic, Mélanges exot.-entom., fasc. vii, p. 19 (Sept. 1913).

Hab. Southern United States; Mexico; Guatemala; Honduras, Ruatan Island; Panama.

Sent in abundance from Teapa in Tabasco. The variety with the prothorax infuscate to near the base has been

named *obscurior* by Pic. Four species were found mixed under the name *B. abdominalis* in the "Biologia" collection, two of them belonging to *Ichthyurus* and two to *Belotus*. Leconte recorded the species from Panama in 1851. The aedeagus of numerous males has been dissected, showing that one of the two long right lateral lobes is usually retracted and not always visible, see Plate VII, fig. 42. I have seen specimens from Texas, etc.

2. **Belotus acuminatus,** n. sp. (Plate III, figs. 16, ♀; 16*a*, ♂.)

Shining, finely pubescent, nigro-piceous or piceous, the apices of the elytra yellow, the mandibles, the anterior half of the head in ♂, the prothorax, a faint attenuate space down the middle of the disc of each elytron, the abdomen (the last two segments excepted), and the anterior legs in great part, testaceous. Head somewhat flattened anteriorly, obsoletely punctate, the eyes small; antennae slender, moderately long in the two sexes, joint 3 twice the length of 2. Prothorax transversely subquadrate, obsoletely punctate, the disc transversely excavate laterally. Elytra about twice the length of the prothorax in ♂, longer and more acuminate in ♀, closely punctulate.

♂. Penultimate dorsal segment of abdomen produced into a small conical prominence on each side at apex, the last segment broad and exposed (fig. 16*a*).

♀. Penultimate dorsal segment of abdomen feebly triangularly produced on each side at apex, the last segment small and narrow.

Length 4–5½ mm. (♂ ♀.)

Hab. Panama, Volcan de Chiriqui (*Champion*: ♂ ♀), La Chorrera (*Dolby-Tyler*: ♂ ♀).

Eleven specimens, six of which are males. Separable from *B. abdominalis* by the more acuminate elytra, this being particularly noticeable in the female, and the very different asymmetric genital armature of the male, see Plate VII, fig. 43. The elytra always have a more or less distinct testaceous or yellowish space extending down the middle of the disc from the base. The Chiriqui examples were left by Gorham under *B. abdominalis*.

3. **Belotus maculatus.**

Belotus maculatus, Gorh., Biol. Centr.-Am., Coleopt. iii, 2, pp. 99, 309.

Hab. Panama, Chiriqui.

This species must be nearly related to *B.* (*Malthinus*) *chevrolati*, Guér., from Brazil, to judge from the author's figure of the latter. The abdomen is entirely testaceous, and the emarginate penultimate dorsal segment of the male has the outer angles deflexed. The head is more narrowed behind the eyes than in *B. abdominalis* and the eyes themselves are more convex. The genital armature is very different from that of the other two species of the genus here enumerated, see Plate VII, fig. 44.

[Lobetus.

Lobetus, Kiesenwetter, Linn. Ent. vii, p. 244 (1852); Lacordaire, Gen. Coleopt. iv, p. 362 (1857) (*nec* Leconte).

The type, ♂, of this genus *L. torticornis*,* Kies., from Venezuela, has the antennae peculiarly formed, the terminal joint of the maxillary palpi long and cultriform, the head broad, and narrowed posteriorly, the eyes prominent and widely separated, the posterior coxae much enlarged, the tarsal claws simple, the penultimate dorsal segment of the abdomen broadly emarginate, leaving a small terminal segment exposed, the seventh ventral segment cleft, and the genital armature asymmetric and greatly developed. The female, subsequently described by Lacordaire, has slender filiform antennae, with a much smaller basal joint and the second and third joints more elongate. There is a pair of this species in the Oxford Museum, apparently received from the traveller A. Sallé, ticketed "Guatemala"; but there must have been some mistake made in labelling, due to Sallé having visited both Venezuela and Guatemala. It is very doubtful whether the various S. American and Antillean *Lobeti* described by Pic in 1906 are really congeneric with *L. torticornis*.]

Pseudolobetus, n. gen.

Head broad, obliquely narrowed behind the eyes, the latter prominent and widely separated; apical joint of the labial palpi stout, securiform, that of the maxillary pair long and cultriform; mandibles sharply toothed towards the apex within; antennae

* This name was incorrectly printed *torticollis* in the diagnosis of the species, but it was correctly given on pp. 322, 323 of Kiesenwetter's work.

inserted near the inner margin of the eyes, long, slender, similar in the two sexes, joint 2 short; prothorax narrow, subquadrate; elytra abbreviated, obliquely attenuate; penultimate dorsal segment of abdomen truncate or broadly emarginate behind, leaving a small terminal segment exposed, the latter bidentate in ♂; legs slender; tarsal claws toothed at the base; genital armature of ♂ asymmetric.

Type, *Malthinus major*, Gorh.

This genus includes *Malthinus major* and *M. championi*, Gorh., both of which may be at once separated from *Malthinus* by the stout palpi. The rapidly and obliquely narrowed head, the very short second antennal joint, the feebly developed prothorax, and the slender legs, distinguish *Pseudolobetus* from *Trypherus*, Lec. (type *Malthinus latipennis*, Germ.); and the simple antennae, toothed mandibles, and basally toothed tarsal claws separate it from *Lobetus*, Kies.

1. **Pseudolobetus major.** (Plate III, figs. 17, ♂; 17*a*, ♀.)

Malthinus major, Gorh., Biol. Centr.-Am., Coleopt. iii, 2, p. 102.

♂. Penultimate dorsal segment of abdomen subtruncate, the outer angles deflexed, the small terminal segment strongly bilobed at apex; anterior tibiae bowed inwards towards the apex.

♀. Penultimate segment feebly subconically produced on each side behind, the small terminal segment feebly emarginate.

Hab. Panama, Chiriqui.

Eighteen specimens seen, six of which are males. A figure of the genital armature is given on Plate VII, figs. 45, 45*a*.

2. **Pseudolobetus championi.**

Malthinus championi, Gorh., Biol. Centr.-Am., Coleopt. iii, 2, p. 102.

♂. Penultimate dorsal segment feebly subconically produced on each side behind, the outer angles not deflexed, the small terminal segment armed with two long narrow spiniform processes.

♀. Penultimate dorsal segment as in ♂, the small terminal segment simple.

Hab. Panama, Chiriqui.

Ten specimens seen, including three males. Separable from *P. major* by the strongly hirsute legs, a character not mentioned in the original description, and the immaculate rufo-testaceous prothorax. The genital armature, too, is very different, see Plate VII, figs. 46, 46*a*.

Group Malthini.

Gorham included all the genera with abbreviated elytra under this group, but as there are various *Chauliognathi* with the elytra incompletely covering the wings (as in many species of *Malthinus*) it is obvious the character is of little value. The species of the three genera here placed under it agree, however, in having a small, acuminate-ovate apical joint to the maxillary palpi, and, so far as at present ascertained, symmetric genital armature.

Thinalmus.

Thinalmus, Gorham, Biol. Centr.-Am., Coleopt. iii, 2, pp. 101 (1881), 309 (1885).

The two species of this genus, which so far as at present known is peculiar to Central America, have the antennae strongly flabellate in the male and sharply serrate in the female. To the characters given for *Thinalmus*, the following may be added: mandibles sharply dentate within; apical joint of the maxillary palpi small, acuminate-ovate; terminal ventral segment cleft in ♂; genital armature symmetric. No fresh material has come to hand since 1885, and there is therefore nothing to add to Gorham's enumeration; but the opportunity is taken to figure the peculiar genital armature of *T. centrolineatus*, see Plate VII, figs. 47, 47*a*. A male of *T. pectinicornis* was figured by Gorham. These insects have the general facies of *Malthodes* and *Malthinus*, but the ♂ abdominal structure is suggestive of *Polemius*, *Silis*, etc.

Malthinus.

Malthinus, Latreille, Gen. Crust. et Ins. i, p. 261 (1806); Gorham, Biol. Centr.-Am., Coleopt. iii, 2, pp. 102, 309.

The numerous Mexican or Central American species of this genus now known may be grouped thus :—

Elytra short, vaguely punctulate.
Antennae slender, the apical joints not paler than those preceding; elytra usually with a yellow apical spot . . *Species* 1–5.
Antennae stouter, the apical one or two joints yellow; elytra wholly infuscate . *Species* 6, 7.
Elytra much longer, nearly covering the wings, coarsely striato-punctate . . . . . *Species* 8–14.

1. **Malthinus ingens,** n. sp.

Belotus sp. no. 4, Gorh., Biol. Centr.-Am., Coleopt. iii, 2, p. 309.

Elongate, comparatively broad, finely pubescent, shining; rufo-testaceous, the eyes black, the tips of the antennae and the elytra fusco-testaceous, the apices of the latter with a darker spot, the wings smoky. Head extremely large, rapidly narrowed behind the moderately developed prominent eyes, closely, excessively minutely punctate; antennae slender, filiform, longer than the body, joints 2–5 increasing in length, 5–9 very elongate. Prothorax transversely subquadrate, sharply margined, uneven, canaliculate down the middle, sparsely, very minutely punctate. Elytra extending to a little beyond the middle of the wings, vaguely punctate and subcostate. Tibiae straight.

Length (excl. head) 7 mm. (♂ ?.)

Hab. Mexico, Jalapa.

Gorham mentioned two specimens of this species, the one sent by Mr. Flohr having been retained by him. *M. ingens* seems to possess all the structural characters of *Malthinus*, and as it is very different from any of the other known species of this section there can be no risk in naming it. It is larger and broader than any of the described American *Malthini*, and has extremely elongate antennae.

2. **Malthinus subulatus,** n. sp.

Testaceous, the eyes black, the antennae (except the basal joint beneath) and elytra nigro-piceous, the convex apices of the latter fusco-testaceous, the wings, and the femora and tibiae in part, fuscous. Head very large, transversely convex, arcuately narrowed behind the moderately developed prominent eyes, densely, very minutely punctate, subopaque; antennae slender, not reaching the tips of the wings, joints 2–4 increasing in length. Prothorax shining, transversely subquadrate, somewhat flattened and obso-

letely canaliculate down the middle of the disc, closely, very minutely punctate. Elytra short, rapidly narrowed from near the base, about reaching the middle of the wings, rather coarsely, confusedly punctate and distinctly costate, the apices minutely punctate.

Length 5½ mm. (♀?.)

Hab. Mexico (*Truqui, in Mus. Brit.*).

One specimen. This species has the head and prothorax shaped very much as in *M. ingens*, but the antennae are formed as *M. brevipennis* and its allies, and the elytra are very short and rapidly narrowed posteriorly. *M. subcostatus*, Schaeff., from Arizona, must be an allied form with the head black, except in front.

3. Malthinus laticeps.

Malthinus laticeps, Gorh., Biol. Centr.-Am., Coleopt. iii, 2, p. 103, pl. 6, fig. 14 (♂).

Hab. Guatemala, Calderas on the slope of the Volcan de Fuego.

The type of this species is the unique male figured, the others quoted from San Géronimo, etc., belonging elsewhere. It has the basal joint of the antennae, the palpi, mandibles, and legs, the outer margins of the prothorax, the sides of the body beneath, and the abdomen in part, testaceous, a large spot at the apex of each elytron yellow, and the rest of the body piceous. Antennae much larger than the body, comparatively stout; head broad, the eyes very large; prothorax small; elytra extending to a little beyond the middle of the wings, vaguely punctulate and subcostate.

4. Malthinus melanocerus, n. sp.

♂. Nigro-piceous, the points of insertion of the antennae, the mandibles, the margins of the prothorax, the legs, and the abdomen in part, testaceous, the elytra fuscous, with a large yellow spot at the apex. Head together with the moderately large prominent eyes about as wide as the elytra, obliquely narrowed posteriorly, densely, very minutely punctate, thus appearing subopaque; antennae slender, longer than the body. Prothorax small, gradually narrowed anteriorly, shining, sparsely, very minutely punctate. Elytra reaching to about the middle of the wings, vaguely punctulate. Penultimate dorsal segment of the abdomen truncate at

apex, the terminal one shallowly emarginate. Posterior tibiae straight.

Length 4½ mm.

Hab. GUATEMALA, San Gerónimo.

Two specimens, assumed to be males, left by Gorham under *M. laticeps*, but differing from that insect in the less widened, subopaque head, the much smaller eyes, and the more slender, less elongate antennae (formed much as in the male of *M. brevipennis*, Gorh.), with dark basal joint. The elytra are a little longer, and the prothorax narrower, than in *M. brevipennis*.

5. Malthinus brevipennis.

Malthinus brevipennis, Gorh., Biol. Centr.-Am., Coleopt. iii, 2, p. 104.

Hab. GUATEMALA, near the city and Dueñas.

The specimens of this species before me apparently include both sexes. It has much smaller eyes than *M. laticeps*, the head pale in front and at the sides behind, the elytra shorter, etc.

6. Malthinus terminalis.

Malthinus terminalis, Gorh., Biol. Centr.-Am., Coleopt. iii, 2, pp. 103, 309.

Hab. PANAMA, Chiriqui.

Found in plenty in Chiriqui. The comparatively stout, pubescent antennae (which have the apical one or two joints yellow), the short prothorax, the very short, wholly infuscate, vaguely punctulate elytra, etc., give this insect a different facies from the typical species of the genus. The mandibles are toothed within. The peculiar genital armature of the male is figured on Plate VII, fig. 48.

7. Malthinus diversicornis, n. sp.

Malthodes pallipes, Gorh., Biol. Centr.-Am., Coleopt. iii, 2, p. 310 (*nec* p. 105) (part.).

Opaque, the elytra slightly shining; piceous, the front of the head, the mandibles, and legs testaceous or obscure testaceous, the last two joints of the antennae pale yellow; head and prothorax alutaceous, minutely punctate, the elytra vaguely punctulate. Head broad, transversely convex, comparatively short, obliquely narrowed behind the eyes in ♂, the eyes moderately large; mandibles sharply

toothed within; antennae (♂) not so long as the body, stout, serrate, pubescent, joints 2–5 gradually increasing in length. Prothorax transverse, short, nearly as wide as the elytra, rounded at the sides anteriorly, conspicuously margined, and finely canaliculate down the middle of the disc. Elytra not quite reaching the middle of the wings, without trace of costae. Penultimate dorsal segment of abdomen (♂) truncate at apex, the terminal one emarginate.

Length 2½–3 mm. (♂ ♀.)

Hab. Panama, Bugaba, Tolé.

Three males and one female, the latter now wanting the antennae, treated by Gorham as a form of his *Malthodes pallipes*. The present insect is nearly related to *Malthinus terminalis*, Gorh., both having sharply toothed mandibles, differing from that species in its much smaller size, opaque surface, stouter antennae, and short, broad prothorax.

8. **Malthinus semirufus,** n. sp.

Shining, finely pubescent; head, prothorax, and scutellum rufo-testaceous, the head flavous in front, the eyes, antennae (except the basal joints beneath), elytra, wings, under surface in part, and dorsal surface of abdomen piceous or nigro-piceous, the legs and rest of under surface pale testaceous. Head extremely large, obliquely narrowed behind the moderately developed prominent eyes, closely punctate, somewhat tumid on the middle of the vertex; antennae slender, moderately long (outer joints broken off). Prothorax broader than long, a little narrower than the elytra, constricted and much narrowed anteriorly, and sinuate at the sides before the base; sparsely, finely punctate, canaliculate down the middle and transversely depressed on the disc behind. Elytra long, incompletely covering the wings, closely, coarsely striato-punctate, the smoother apical patch vaguely punctulate. Tibiae straight.

Length 5 mm.

Hab. Mexico (*Mus. Oxon.*).

One specimen, assumed to be a male. A large, exaggerated form of the Guatemalan *M. cruenticeps*, Gorh., with an enormous head and a greatly developed prothorax, both of which are rufo-testaceous in colour.

9. **Malthinus cruenticeps.**

Malthinus cruenticeps, Gorh., Biol. Centr. Am., Coleopt. iii, 2, p. 104 (excl. var., p. 310).

Hab. Guatemala, Cubilguitz in Alta Vera Paz, 1050 ft.

Unique. This species may be known by its red head, with the anterior portion flavescent, black prothorax and elytra, and infuscate tibiae and tarsi; head very large, closely punctate, much narrowed behind the prominent eyes, the antennae slender, moderately long; prothorax strongly constricted before the middle and narrow thence to the apex, sparsely punctate, canaliculate on the disc; elytra long, incompletely covering the wings, coarsely striato-punctate. The type is apparently a male. The Chiriqui specimens subsequently referred to the same species must be separated. The localities for these two insects are wholly dissimilar in character and widely distant.

10. **Malthinus flavipes.**

Malthinus flavipes, Gorh., Biol. Centr.-Am., Coleopt. iii, 2, pp. 105, 310.

Hab. GUATEMALA, San Gerónimo in Baja Vera Paz.

Gorham in his " Supplement " (loc. cit. p. 310) expressed some doubt as to his *M. flavipes* being distinct from *M. cruenticeps*, the latter having the basal half of the head black, the prothorax densely punctate and with the tubulate narrow anterior portion still more pronounced, and the legs wholly testaceous. They must be retained as distinct. The type seems to be a male.

11. **Malthinus montivagus,** n. sp.

Malthinus cruenticeps, var., Gorh., Biol. Centr.-Am., Coleopt. iii, 2, p. 310.

Shining, piceous or nigro-piceous, the head (except a dark spot or transverse space towards the base in some examples) rufescent or testaceous, yellowish-white in front, the basal joint of the antennae, the margins of the prothorax, the abdomen and under surface in part, and the legs testaceous, the elytra in one example with the smooth apical space yellow and an indeterminate streak down the disc testaceous. Head large, obliquely narrowed behind the prominent eyes, sparsely, minutely punctate; antennae slender, moderately long, shorter than the body in both sexes. Prothorax small, moderately constricted before the middle and gradually narrowed thence to the apex, sparsely, minutely punctate, canaliculate

on the disc. Elytra long, not quite covering the wings, closely striato-punctate. Legs long; tibiae straight.

Length 4–4½ mm. (♂ ♀.)

Hab. Panama, Volcan de Chiriqui 8000 ft.

A long series, showing no approach towards *M. cruenticeps* or its near ally *M. flavipes*. The smaller, testaceo-marginate prothorax, the sides of which are much less constricted before the middle, the smoother head, and the wholly testaceous legs readily distinguish *M. montivagus* from *M. cruenticeps*. The variety with a pale streak down the disc and a yellow apical spot to the elytra approaches the Mexican *M. luteolineatus*, Pic, from which it may be known by the more polished head, etc. The genital armature is figured on Plate VII, figs. 49, 49*a*, *b*.

12. Malthinus luteolineatus.

Malthinus luteolineatus et var. *notatipes*, Pic, L'Échange, 1910, p. 5.

Hab. Mexico (*Truqui*, *in Mus. Brit.*), Jalapa.

Three specimens from the Fry collection, one with the posterior knees infuscate, doubtless belong to this species, the types of which were from Jalapa. They have long, closely striato-punctate, pale testaceous elytra, with the sutural half more or less infuscate and a spot at the apex yellow; the head, except in front, and the disc of the prothorax, piceous or reddish; the basal joint of the antennae testaceous. The head is large and much narrowed behind the prominent eyes, and the prothorax is constricted and much narrowed anteriorly. Length 4½ mm. This Mexican insect is very like the European *M. fasciatus*, Schönh., but differs from it in having the second joint of the antennae more or less infuscate, the head and prothorax duller and less distinctly punctate, the prothorax more strongly sinuate at the sides before the middle, and the elytra more elongate.

13. Malthinus schneideri.

Malthinus schneideri, Pic, L'Échange, 1910, p. 5.
Malthinus sp. no. 8, Gorh., Biol. Centr.-Am., Coleopt. iii, 2, p. 310.

Hab. Mexico, Jalapa (*coll. Pic*, *Höge*).

This insect is almost wholly testaceous, with the excep-

tion of a patch on the vertex and a broad space down the middle of the prothorax, which are infuscate, and a yellow spot at the apex of each elytron. Head very large and exserted, rapidly narrowed behind the prominent eyes, shining, and densely punctate; prothorax about as long as broad, abruptly constricted and narrowed anteriorly, shining, very sparsely punctate; elytra long, closely, coarsely striato-punctate; posterior tibiae feebly bowed in male. Length 6 mm.

14. Malthinus jalapanus.

Malthinus jalapanus, Pic, L'Échange, 1910, p. 6.

"Très voisine de *schneideri*, d'une coloration analogue (et dont je ne connais qu'un ♂) que je désigne sous le nom de *jalapanus*, est de taille plus petite avec les élytres moins fortement ponctués, la macule foncée de la tête est moins nette, les tibias postérieures sont droits et l'abdomen est distinctement entaillé à son extrémité. Long. 4 mm."

Hab. Mexico, ? Jalapa (*coll. Pic*).

Apparently not represented in the Mexican collections before me.

Malthodes.

Malthodes, Kiesenwetter, Linn. Ent. vii, p. 265 (1852); Gorham, Biol. Centr.-Am., Coleopt. iii, 2, pp. 105, 310.

The three Central-American species described by Gorham are each represented by a single example in the "Biologia" collection, and I have not ventured to soften them so that the mouth-parts could be examined. It is probable that one or more of them belongs to *Malthinus*. *M. gorhami*, Pic, however, has the mandibles unarmed. There is in the same collection an unnamed species from Chihuahua closely related to *M. sanguineicollis*, Gorh., from Chiriqui.

1. Malthodes pallipes.

Malthodes pallipes, Gorh., Biol. Centr.-Am., Coleopt. iii, 2, p. 105 (*nec* p. 310).

Hab. Guatemala, Zapote and El Tumbador, Pacific slope.

Three dissimilar forms were placed under this name by Gorham, one of which has since been described by Pic,

the other is a *Malthinus*. The type (♂), from Zapote, is a small, shining, nigro-piceous insect, with slender antennae, the last two joints of which are yellow, and rather small eyes.

1 (A). **Malthodes gorhami.**

Malthodes gorhami, Pic, Mélanges exot.-entom., fasc. viii, p. 10 (1913).

Hab. GUATEMALA, Zapote; PANAMA, Bugaba [type], David.

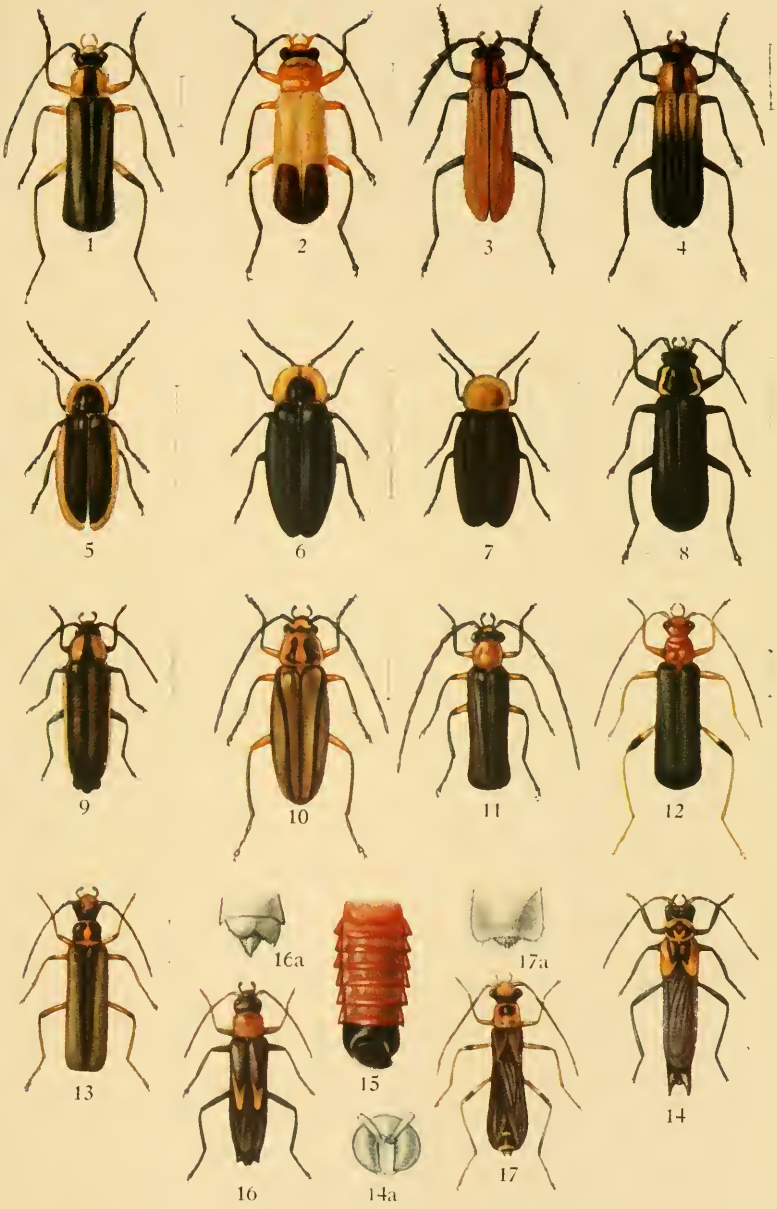
Found by Pic mixed with *M. pallipes* in the Gorham collection. The five specimens before me include the two sexes. The stout, dark, antennae, which are considerably elongated in the male, and the much larger eyes, separate *M. gorhami* from *M. pallipes*. The mandibles are thickened in their basal half, but there is no definite tooth on their inner edge. The abdomen is elongated and not wholly covered by the wings in the male.

EXPLANATION OF PLATES III—IX.

[*See Explanations facing the* PLATES.]

Explanation of Plate III.

Fig. 1. *Discodon subtenue*, n. sp., ♂.
2. ,, *divisum*, n. sp., ♂.
3. ,, *cardinale*, n. sp., ♂.
4. ,, *subulicorne*, n. sp., ♂.
5. *Photinomorpha simulans*, n. sp., ♂.
6. ,, ,, var., ♀.
7. ,, *dilaticornis*, n. sp., ♀.
8. *Polemius nigromarginatus*, n. sp., ♂.
9. ,, *fleximargo*, n. sp., ♀.
10. ,, *bivittatus*, Gorh., var. *β*, ♀.
11. ,, *megalophthalmus*, n. sp., ♂.
12. *Parasilis colyphoides*, Gorh., ♂.
13. *Malthaster suturalis*, Gorh., ♀.
14. *Ichthyurus dichelifer*, n. sp., ♀.
14*a*. ,, ,, head from in front, ♀.
15. *Maronius dichrous*, Gorh., abdomen, dorsal aspect, ♂.
16. *Belotus acuminatus*, n. sp., ♀.
16*a*. ,, ,, tip of abdomen, dorsal aspect, ♂.
17. *Pseudolobetus* (*Malthinus*) *major*, Gorh., ♂.
17*a*. ,, ,, ,, ,, tip of abdomen, dorsal aspect, ♀



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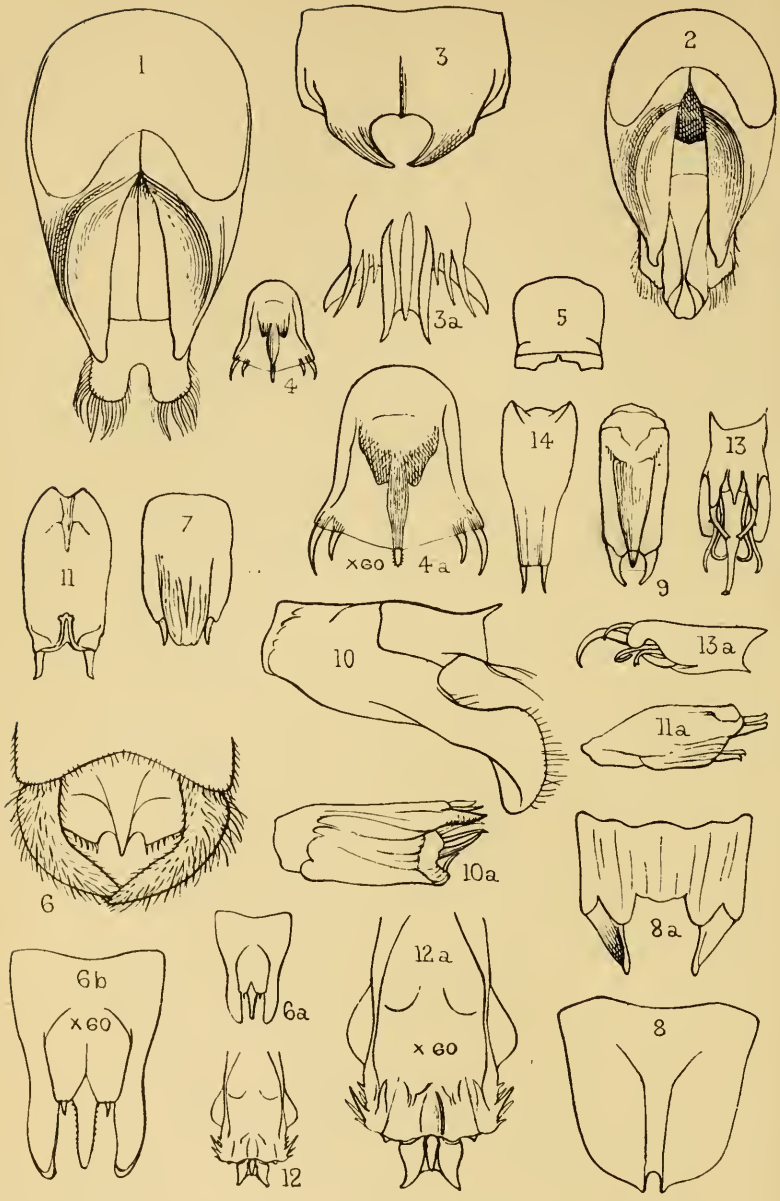
MEXICAN AND CENTRAL AMERICAN TELEPHORINÆ.



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MEXICAN AND CENTRAL AMERICAN TELEPHORINAE.

Explanation of Plate IV.

♂. Terminal segments and genital armature.

The figures on this and the following three plates (all × 30, except the few enlarged to × 60 specially noted) show one or more of the terminal abdominal segments—in their natural position or in profile, or the portions of the genital armature exposed in the dried specimens examined. In some of them the armature is completely evaginated, in others it is partly or entirely withdrawn into the internal sac; but the selection given shows the general arrangement and position of the various pieces, both in the evaginated and non-evaginated condition, in *Discodon*, *Polemius*, etc.

Fig. 1. *Podabrus mexicanus*, Gorh.: terminal segments, ventral aspect.

2. ,, *caliginosus*, n. sp.: terminal segments, with the membranous unarmed internal sac partially extruded.

3, 3*a*. *Discodon erosum*, Gorh., ♂: 3, eighth ventral segment; 3*a*, genital armature [injured by dissection and perhaps incorrectly placed].

4, 4*a*. ,, *emarginatum*, n. sp.: 4, ninth ventral segment and a portion of the genital armature; 4*a*, ditto, × 60.

5. ,, *sinuatum*, n. sp.: eighth ventral segment.

6, 6*a*, *b*. ,, *podabroides*, Pic: 6, ventral segments 6–8, 7 developed into a pair of forceps; 6*a*, ninth segment and a portion of the genital armature; 6*b*, ditto, × 60.

7. ,, *plicatum*, Gorh.: ninth ventral segment and a portion of the genital armature.

8, 8*a*. ,, *stramineicolle*, n. sp.: 8, eighth ventral segment; 8*a*, ninth ventral segment and a portion of the genital armature.

9. ,, *fuscipenne*, n. sp.: ninth ventral segment and a portion of the genital armature.

10, 10*a*. ,, *inconstans*, n. sp.: 10, eighth ventral segment, in profile, the dorsal portion of the same segment visible; 10*a*, ninth segment, and a portion of the genital armature, in profile.

11, 11*a*. ,, *biolleyi*, n. sp.: 11, ninth ventral segment and a portion of the genital armature; 11*a*, ditto, in profile.

12, 12*a*. ,, *vitticolle*, Gorh.: 12, genital armature; 12*a*, ditto, × 60.

13, 13*a*. ,, *chiriquense*, Pic: 13, genital armature; 13*a*, ditto, in profile.

14. ,, *sinuaticolle*, n. sp.: ninth ventral segment and a portion of the genital armature.

Explanation of Plate V.

♂. Terminal segments and genital armature.

Fig. 15. *Discodon amplipenne*, n. sp.: ninth ventral segment and a portion of the genital armature.

16, 16*a*. „ *cleroides*, Gorh.: 16, genital armature, completely everted; 16*a*, ditto, in profile.

17. „ *melancholicum*, Gorh.: ninth ventral segment and a portion of the genital armature.

18, 18*a*. „ *calidum*, Gorh.: 18, eighth ventral segment; 18*a*, ninth ventral segment and a portion of the genital armature.

19. „ *purpurascens*, Gorh.: eighth and ninth ventral segments and the partially evaginated genital armature.

20. „ *histrio*, Gorh.: eighth and ninth ventral segments, and a portion of the genital armature, in profile, the dorsal portion of the eighth segment visible.

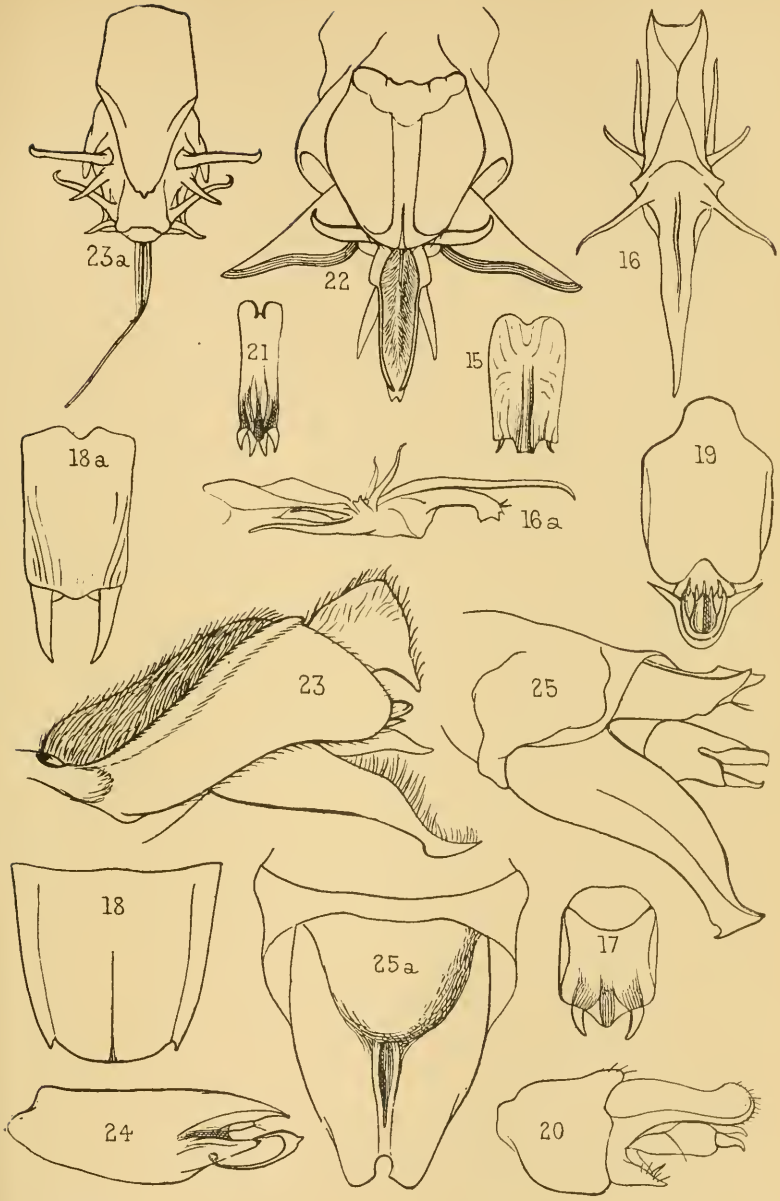
21. „ (*Silis*) *varians*, Gorh.: ninth ventral segment and a portion of the genital armature.

22. „ *lampyroides*, Gorh.: genital armature, completely evaginated.

23, 23*a*. „ *normale*, Gorh.: 23, terminal segments, in profile, the lower portion showing one of the two angulate lobes of the eighth ventral segment; 23*a*, genital armature, completely evaginated.

24. „ *perplexum*, Gorh.: ninth segment and a portion of the genital armature, in profile.

25, 25*a*. „ *luridum*, Gorh.: 25, terminal segments, in profile, the lower portion showing one of the angulate lobes of the eighth ventral segment; 25*a*, eighth ventral segment.



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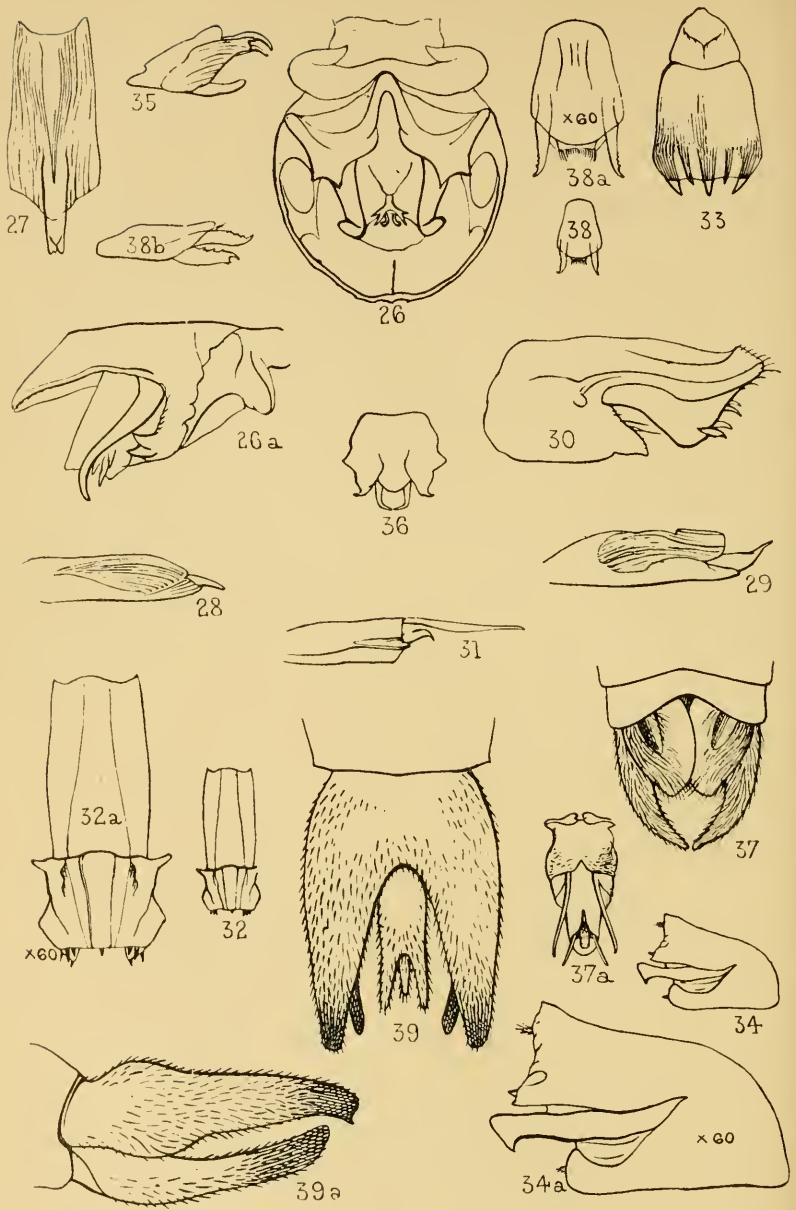

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MEXICAN AND CENTRAL AMERICAN TELEPHORINAE.

Explanation of Plate VI.

♂. Terminal segments and genital armature.

Fig. 26, 26*a*. *Photinomorpha simulans*, n. sp.: 26, genital armature, partly evaginated, seen from the dorsal aspect, showing the bidentate apical portions of the eighth segment and the long, stout hook on each side of the internal sac; 26*a*, ditto, in profile.

27. *Polemius integer*, n. sp.: ninth segment and a portion of the flattened central tube, dorsal aspect.

28. ,, *nigrolimbatus*, n. sp.: ninth ventral segment, in profile.

29. ,, *nigromarginatus*, n. sp.: ninth ventral segment, in profile.

30. ,, (*Discodon*) *difficilis*, Gorh.: eighth and ninth segments, and a portion of the genital armature, in profile.

31. ,, (*Discodon*) *photinoides*, Gorh.: ninth segment and a portion of the genital armature, showing the very long flagellum, in profile.

32, 32*a*. ,, *tristiculus*, n. sp.: 32, ninth ventral segment and the partly evaginated genital armature; 32*a*, ditto, × 60.

33. ,, (*Discodon*) *bivittatus*, Gorh.: ninth ventral segment and a portion of the genital armature.

34, 34*a*. ,, *fuscovittatus*, n. sp.: 34, eighth and ninth segments, and a portion of the genital armature, in profile; 34*a*, ditto, × 60.

35. ,, *megalophthalmus*, n. sp.: ninth ventral segment and a portion of the genital armature, in profile.

36. *Silis dilacerata*, Gorh.: ninth ventral segment and a portion of the genital armature.

37, 37*a*. *Parasilis colyphoides*, Gorh.: 37, ventral segments, 5–7, and the forcipate last dorsal segment; 37*a*, eighth ventral segment and the genital armature.

38, 38*a*, *b*. *Malthaster suturalis*, Gorh.: 38, ninth ventral segment and a portion of the genital armature; 38*a*, ditto, × 60; 38*b*, profile, × 60.

39, 39*a*. *Ichthyurus dichelifer*, n. sp.: 39, terminal segments, from above; 39*a*, ditto, in profile.

Explanation of Plate VII.

♂. Terminal segments and genital armature.

Fig. 40, 40*a*. *Maronius dichrous*, Gorh.: 40, asymmetric genital armature; 40*a*, ditto, in profile.

41, 41*a*. „ *longicollis*, n. sp.: 41, asymmetric genital armature; 41*a*, ditto, in profile.

42. *Belotus* (*Lobetus*) *abdominalis*, Lec.: asymmetric genital armature, in profile.

43. „ *acuminatus*, n. sp.: asymmetric genital armature.

44. „ *maculatus*, Gorh.: asymmetric genital armature.

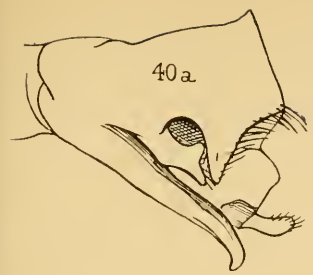
45, 45*a*. *Pseudolobetus major*, Gorh.: 45, asymmetric genital armature; 45*a*, ditto, in profile.

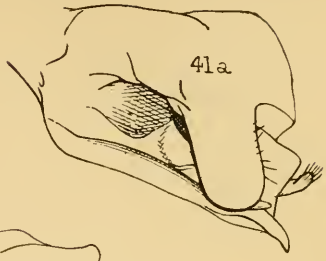
46, 46*a*. „ *championi*, Gorh.: 46*a*, asymmetric genital armature; 46, ditto, in profile.

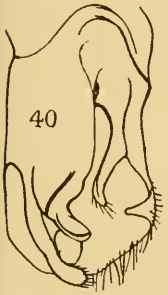
47, 47*a*. *Thinalmus centrolineatus*, Gorh.: 47, genital armature; 47*a*, ditto, in profile.

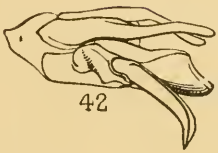
48. *Malthinus terminalis*, Gorh.: genital armature, in profile.

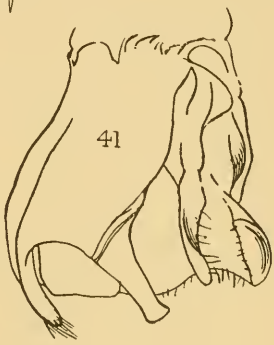
49, 49*a*, *b*. *Malthinus montivagus*, n. sp.: 49, genital armature; 49*a*, ditto, × 60; 49*b*, in profile, × 60.

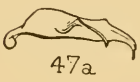






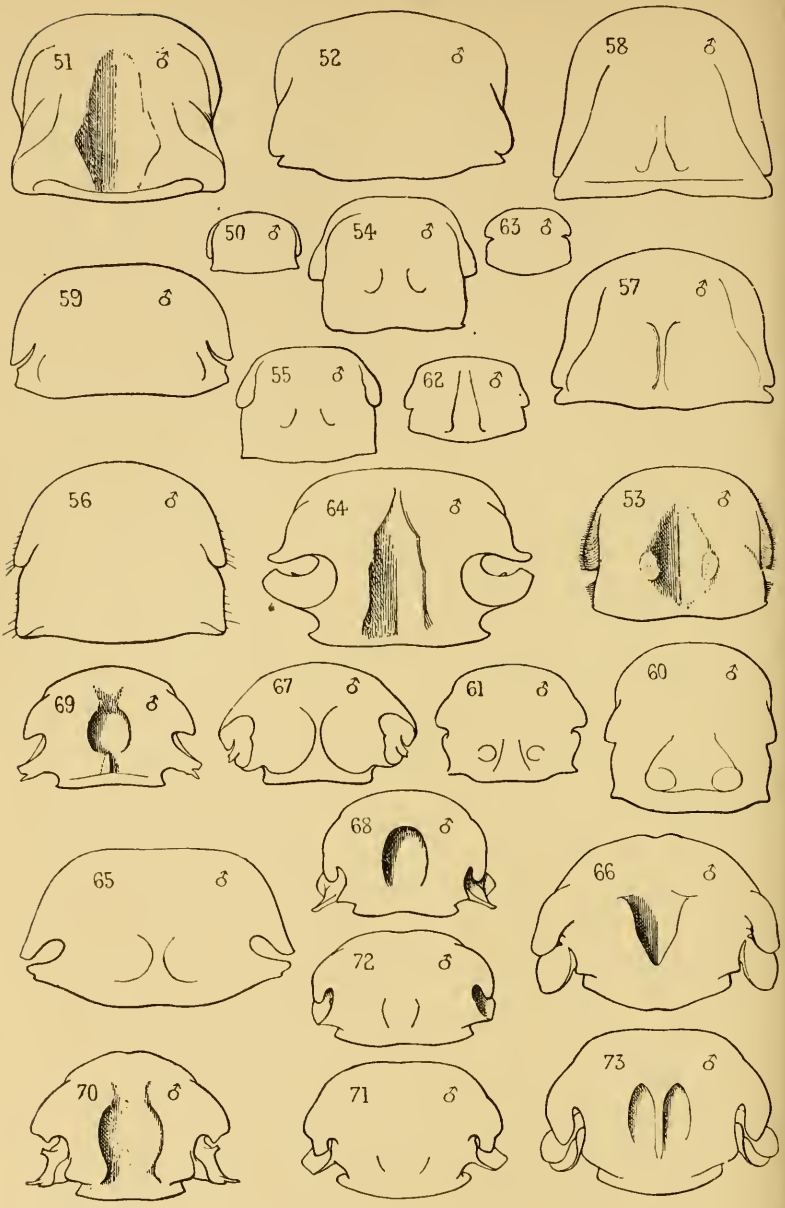






H. Knight, del.

MEXICAN AND CENTRAL AMERICAN TELEPHORINAE.



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MEXICAN AND CENTRAL AMERICAN TELEPHORINAE.

Explanation of Plate VIII.

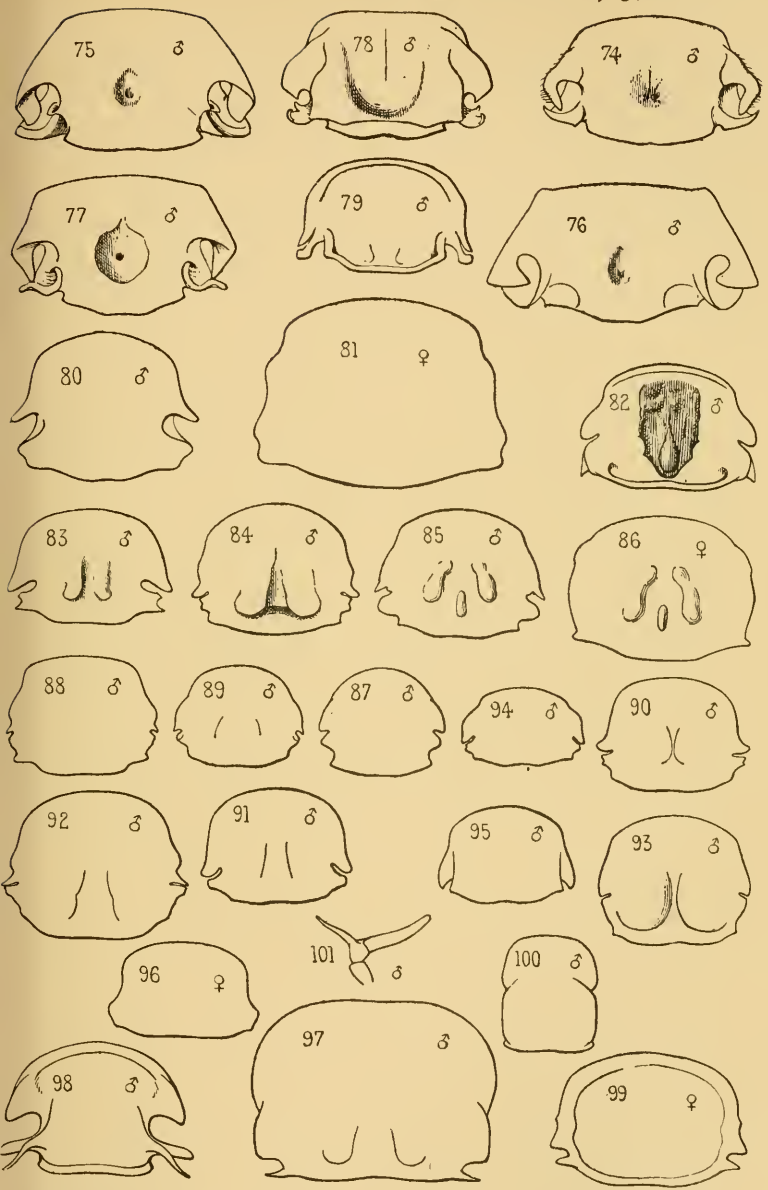
Prothorax: all × 20.

Fig. 50. *Plectonotum labiale*, Gorh., ♂.
51. *Discodon marginatum*, Gorh., ♂.
52. „ *maurum*, n. sp., ♂.
53. „ (*Silis*) *anale*, Gorh., ♂.
54. „ (*Silis*) *hilarum*, Gorh., ♂.
55. „ (*Silis*) *pauxillum*, Gorh., ♂.
56. „ (*Silis*) *combustum*, Gorh., ♂.
57. „ (*Silis*) *varians*, Gorh., ♂.
58. „ (*Silis*) *serrigerum*, Gorh., ♂.
59. *Polemius spissicornis*, n. sp., ♂.
60. „ (*Telephorus*) *cephalotes*, Gorh., ♂.
61. „ *dentimargo*, n. sp., ♂.
62. „ (*Silis*) *minutus*, Gorh., ♂.
63. „ *ornaticollis*, n. sp., ♂.
64. *Silis longidens*, n. sp., ♂.
65. „ *laticollis*, Gorh., ♂.
66. „ *distorta*, Gorh., ♂.
67. „ *torticollis*, Gorh., ♂.
68. „ *trilobata*, n. sp., ♂.
69. „ *dilacerata*, Gorh., ♂.
70. „ *acantholobus*, n. sp., ♂.
71. „ *biauriculata*, n. sp., ♂.
72. „ *bilamellata*, n. sp., ♂.
73. „ *ludicra*, Gorh., ♂.

Explanation of Plate IX.

Prothorax, etc.: all × 20.

Fig. 74. *Silis albicincta*, Gorh., ♂.
75. „ „ „ var. ♂.
76. „ *jocosa*, Gorh., ♂.
77. „ *festiva*, Gorh., ♂.
78. „ *erythrodiscus*, n. sp., ♂.
79. „ *laciniosa*, n. sp., ♂.
80. „ *lycoides* (= *praemorsa*), Gorh., ♂.
81. „ „ Gorh., ♀.
82. „ *eroides*, Gorh., ♂.
83. „ *sepulchralis*, Gorh., ♂.
84. „ *nigrita*, Gorh., ♂.
85. „ *fissicollis*, n. sp., ♂.
86. „ „ „ ♀.
87. „ *lineata* (= *lineola*), Gorh., ♂.
88. „ *oblita*, Gorh., ♂.
89. „ *scabripennis*, n. sp., ♂.
90. „ *haematodes*, Gorh., ♂.
91. „ *melanocephala*, Gorh., ♂.
92. „ *transfixa*, Gorh., ♂.
93. „ *fulvipes*, Gorh., ♂.
94. „ *ocularis*, Gorh., ♂.
95. „ *appendicularis*, Gorh., ♂.
96. „ *aurita*, Gorh., ♀.
97. „ *chalybeipennis*, Gorh., ♂.
98. „ *Ditemnomorphus* (*Silis*) *rufifrons*, Gorh., ♂.
99. „ „ „ „ ♀.
100. *Malthaster suturalis*, Gorh., ♂.
101. *Ichthyurus* (*Lobetus*) *mirabilis*, Gorh., ♂: joints 2–4 of maxillary palpus.



H. Knight, del.

MEXICAN AND CENTRAL AMERICAN TELEPHORINAE.

III. *Descriptions of New Species of the* Pierine *genera* Catasticta *and* Daptoneura.

By J. J. Joicey, F.L.S., F.Z.S., and W. F. H. Rosenberg, F.Z.S.

[Read October 7th, 1914.]

Plate X.

Catasticta rosea, sp. n. (Plate X, fig. 7.)

Near *C. uricoecheae*, Feld., but wings emarginate.

Upperside :—Fore-wing smoky brown. A spot in the cell at its end; a median band of 6 spots from cellule 5 to the inner margin, the two first being the smallest; a submarginal row of 8 spots which are proximally sagittate. All these spots are yellowish-white, not pure white as in *C. uricoecheae*.

Hind-wing smoky brown at extreme base, then pale rose pink, with a longitudinal yellowish-white streak in the cell. A median band of smoky brown which crosses the end of the cell, where it is broken by the pinkish colour which cuts off a spot in the cell end. The proximal edge of this band is straight and does not extend to the bases of cellules 3 and 5. A marginal band of smoky brown narrowly separated from the median band, the space between being pinkish with ill-defined narrow yellow spots placed longitudinally in 10 to 6, and invading the median band. A marginal row of rose-coloured spots.

Underside :—Fore-wing as above but spots reduced and yellower, and with a marginal row of pale yellow streaks joining the submarginal sagittate spots; the points of these latter are tipped with black. Hind-wing light chocolate-brown, with a narrow pale pink median band cutting the cell beyond the middle, and an ill-defined submarginal band of the same colour. Primrose-yellow streaks as follows :—one bordered with black and running the entire length of the centre of the cell and with a black spot before its end, two in 1*c* and one each in 2 to 7 all joining the marginal rosy spots; these streaks are bordered and tipped with black; a thick streak in 1*a* and one in 1*b*, joining the margin. A primrose-yellow spot lying at the end of a larger and quadrate black spot near the base of cellule 7. The yellow streaks in 1*c*, 6 and 7, cross the median band. Costal margin rosy near the base.

Antennae, head and thorax black. Abdomen brownish-black with ventral surface yellow. Length of fore-wing 28 mm.

Type, ♂, Colombia, in the collection of Mr. J. Joicey, ex. coll. Grose-Smith.

Catasticta fulva, sp. n. (Plate X, fig. 3.)

Allied to *incerta*, Dogn., but differs above in the deeper yellow colour and reduction of the markings. On the fore-wing a spot at the end of the cell; the spots of the discal band somewhat smaller than in *incerta*, the marginal spots vestigial. On the hind-wing the basal yellow of *incerta* is here reduced to a narrow band crossing the cell at its middle, the base being dark brown as the ground-colour. A distinct spot at the end of the cell. The submarginal spots are a little smaller than in *incerta* and the spot at the base of cellule 2 in *incerta* is here reduced to a slight powdering. The marginal spots are smaller than in *incerta*.

Underside :—Colour as in *incerta*. On the fore-wing a large double spot at end of cell, and a narrow yellow streak running from it to the base. Discal and marginal spots smaller than in *incerta*. On the hind-wing the dark band which crosses the cell at its end is darker than in *incerta*, its proximal edge being well defined. The apices of the submarginal silvery spots are shorter than in *incerta*, being much shortened in 1*c* and 2, the marginal spots are smaller. Length of fore-wing 23 mm.

Type, a ♂, in Collection Joicey, from Pozuzo, Peru, 5000–8000 ft. Adams Collection (British Museum), 4 specimens from Peru. Collection Rosenberg, 2 from Huancabamba, N.E. Peru.

Catasticta huancabambensis, sp. n. (Plate X, fig. 4.)

♂. Upperside :—Dark-brown, discal band and submarginal spots tawny-yellow powdered with brown scales. Near *C. reducta*, Btl., from which it differs in the deeper yellow of the discal band and spots, in the narrower discal band of the fore-wing which is reduced to a row of oblong spots, in there being no yellow scaling within the cell, except an indistinct tawny-yellow spot at the distal end. The band of the hind-wing is reduced to a somewhat narrow discal band which crosses the cell at its middle; in *C. reducta* the yellow colour extends to the base of the wing. The submarginal spots of the hind-wing are sagittate as in *C. seitzi*, Lathy and Rosenberg, instead of round as in *reducta*, and there is a well-defined spot at end of cell.

Underside :—Much as in *reducta*, but the discal band on the fore-wing is again reduced and of a deeper yellow, which latter distinction applies also to the submarginal spots. A narrow yellow streak runs the length of the cell, when it joins a yellow spot corresponding to that on the upperside; this yellow streak is much obscured by brown scaling in some specimens. On the hind-wing the dark discal band is wider than in *C. reducta* and the submarginal white spots are reduced in size, otherwise there is little difference. Length of fore-wing 23 mm.

Type in Joicey Collection from Huancabamba, N. Peru. A series in Joicey Collection, 1 in Rosenberg Collection from the same locality; in Adams Collection (British Museum), 3 from Huancabamba, and 1 from La Merced, Peru, 2500 ft., 1904 (*Watkins* and *Tomlinson*).

Catasticta grisea, sp. n. (Plate X, fig. 5.)

This strikingly distinct species comes near *C. strigosa*, Btl., but smaller and may be at once distinguished above by the absence of the submarginal row of streaks on the fore-wing, by the ground-colour of the wings above being dull black instead of brown, and by the colour in the cells and the striations or rays between the veins being bluish-grey instead of greenish-grey. The rays of the hind-wing are rounded distally in this species, but pointed in *strigosa*.

Underside :—Fore-wing dull black, no streak in the cell, but a double yellowish-white spot at the end. A median row of white spots, increasing in size towards the hind margin. A submarginal row of small sagittate markings, of which the four nearest the costa have the apices tipped with yellow. A marginal row of short yellow streaks. Hind-wing much as in *strigosa*, but ground-colour darker and yellow spots reduced. A well-marked median band of white spots crossed by yellow streaks. Two red spots at base as in *C. strigosa*. Length of fore-wing 22 mm.

Type, a ♂, Pozuzo, Peru, in the collection of J. J. Joicey. Two specimens in the Tring Museum from Chanchamayo and Cushi, Peru.

Catasticta talboti, sp. n. (Plate X, fig. 6.)

Near *C. philone*, Feld., but ground-colour above lighter brown. Median band and submarginal spots on both wings white with a slight yellowish tinge, and slightly powdered with brown scales, especially on submarginal spots of hind-wing, these latter being

larger than in *philone*, wedge-shaped, and almost obscured by the brown scales. Submarginal spots on fore-wing rounder than in *philone*.

Below the spots on fore-wing are whitish instead of yellowish, and the submarginal row is straighter and closer to the discal spots than in *philone*. On the hind-wing the discal band is narrower and the submarginal silvery spots are less heavily margined with brown distally. Length of fore-wing 25 mm.

Abdomen more thickly scaled with whitish than in *philone*.

Type, without locality, in Joicey Collection, ex. Grose-Smith Collection. There are two specimens of this species in the Felder Collection under *C. philone*, bearing this name in Felder's writing and labelled "Bogota," but they do not agree with his type of *philone*, which is from Ecuador.

Catasticta noakesi, sp. n. (Plate X, fig. 1.)

♂ near *C. fliza*, H.-S., but median bands on both wings broader and more clearly defined, and these bands as well as the submarginal and marginal rows of spots are pale yellow instead of white. The marginal spots are larger than in *C. fliza*, and there is a pale yellow spot at the end of cell in fore-wing. 28·5 mm.

Underside :—Median band of fore-wing white as in *C. fliza*, but spots composing it somewhat larger and more defined. A white triangular spot at end of cell, larger than the corresponding spot on upperside. Submarginal and marginal spots as in *C. fliza* but larger. Hind-wing, ground-colour somewhat darker than in *fliza*, so that the dark streaks between the nervules are not so apparent; the white median band is much wider and sharply defined, and the yellow streaks on that band are broader, the yellow colour predominating over the white. Length of fore-wing 28 mm.

♀. Upperside :—The median band and all spots deeper yellow than in the ♂, and submarginal spots on the fore-wing and the submarginal and marginal spots on the hind-wing are larger and rounder. The median band on both wings broader and the yellow spot at end of cell in fore-wing much larger.

Underside :—Fore-wing differs from the ♂ in median band and all spots being pale yellow and larger. Hind-wing as in ♂, but median band rather wider and submarginal and marginal spots rounder and somewhat larger. Shape of wings rounder than in ♂. Length of fore-wing 28 mm.

Types of ♂ and ♀ in the collection of J. J. Joicey, from Valdevia, Colombia, 1897 (*Pratt*).

Explanation of Plate X.

Fig. 1. *Catasticta noakesi*, ♂, p. 150.
2. ,, ,, ♀, p. 150.
3. ,, *fulva*, p. 148.
4. ,, *huancabambensis*, p. 148.
5. ,, *grisea*, p. 149.
6. ,, *talboti*, p. 149.
7. ,, *rosea*, p. 147.
8. *Daptoneura nigricosta*, p. 151.

West, Newman ch

NEW SPECIES OF CATASTICTA AND DAPTONEURA

Daptoneura nigricosta, sp. n. (Plate X, fig. 8.)

Allied to *lysimnia*, Crm., but differing from all the species in this genus in the costal streak on fore-wing below.

Upperside :—Fore-wing white, apex and outer margin brownish-black, the basal half of costa powdered with black to before the end of cell. Hind-wing white with a brownish-black distal border 2 mm. wide which is slightly produced at the intraneural folds.

Underside :—Fore-wing white, apical area paler than above and bearing a round yellow spot in cellule 6 and a smaller one in 8, three indistinct whitish spots in 3, 4 and 5. An oblong brownish-black patch at end of cell, joining the costa and produced along it to its base and entering the cell for its entire length. Hind-wing lemon yellow with a brownish-black distal margin 4 mm. wide from vein 7 to the inner margin ending at a point beyond the first submedian. Length of fore-wing 31 mm.

Type, a ♂, with no locality, in the collection of J. J. Joicey.

Explanation of Plate X.

[*See Explanation facing the* Plate.]

IV. *Further Observations on the Structure of the Scent Organs in certain male* Danaine *Butterflies.* By H. Eltringham, M.A., D.Sc., F.Z.S.

[Read December 2nd, 1914.]

Plates XI–XX.

On a former occasion * I described at some length the structure of the scent-glands and brushes in the Danaine butterfly *Amauris niavius*, Linn. I am greatly indebted to my friends Mr. W. A. Lamborn, Mr. J. C. Moulton, Lieut.-Col. Manders, Mr. S. A. Neave, Mr. C. A. Rogers, and Mr. C. A. Wiggins for further material in the form of butterflies suitably preserved, enabling me to cut sections and investigate the structure of similar glands in other species. I am also much indebted to my friends Prof. E. B. Poulton and Dr. F. A. Dixey for kindly looking over the proofs of the present paper. It may be useful to recall that in the case of *A. niavius* the scent-glands were found to be located in the patch on the hind-wing submedian nervure. Each gland consisted of several cells communicating on the upper surface of the wing with a projection which I called a "scent-cup." This structure was provided with a cover pierced in the centre by a minute pore. Each scent-cup was also protected by a small scale, differing from the normal wing-scales in size and shape.

The two brushes situated in the hinder end of the abdomen consisted of tufts of chitinous hairs † arising from trichogenic cells in a membranous sac, the eversion of which by fluid pressure causes the extrusion of the brush. In

* Trans. Ent. Soc. Lond., p. 399 *et seq.*, 1913.

† It has been pointed out to me that the insect structures commonly referred to as hairs are not hairs in the true morphological sense, and of this I am, of course, aware. At the same time, when speaking of hairs in connection with insects, we mean insect hairs or the hair-like structures (setae, modified scales, etc.), which are found on insects, and I do not think that any confusion need arise on this point.

addition to these structures it was found that a certain area of the brush-bag contained cells which produced numerous delicate chitinous filaments, these having the property of breaking up transversely into innumerable tiny particles, thus forming a kind of dust, the suggestion being that these particles assisted in the diffusion of the scent.* Reference was also made to the fact that these butterflies are known to apply their brushes to the patches on the wings.

Having thus briefly reviewed the conclusions already attained in my previous paper, I propose to describe the corresponding structures in certain other species of butterflies, and it will be seen that complicated as is the arrangement in *A. niavius*, differentiation has reached an even higher development in other forms. Neither wing-glands nor dust-producing devices are invariably present; the brush itself and not the wing may produce the scent material, or at least exhibit a glandular structure, whilst the dust may be produced by the wing and not by the brush, and in the pupal instead of in the imaginal state.

I propose to describe each species separately, after which the results may be considered.

Amauris psyttalea, Plötz.

Of this species I have had only one body to examine. It was sent to me by Mr. C. A. Wiggins, who did not then understand that I required the wings as well. I am thus unable to describe the wing-brands except from such information as can be gathered from the examination of dried examples. From these, however, it is clear that the arrangement is very similar to that in *A. niavius*. Regular rows of "scent-cups" are seen, each covered by a small scale arising from a socket placed between two of the scent-cups in the adjacent row. The scales resemble those in *niavius*, though they are slightly less rounded. The glands are probably similar to those in *niavius*. From the single abdomen available I was able to make both transverse and longitudinal sections of the brushes, and these proved extremely interesting. From the base of the brush there arises a pencil of hairs corresponding in

* This idea of the function of the dust particles was in part due to the suggestion of my friend Dr. Karl Jordan, a fact which I regret I omitted to acknowledge in my previous paper.

every way with the "yellow hairs" * in the brush of *niavius*. Pl. XI, fig. 1, is a photograph of a section of the brush near the base. It will be noted that there are a few small dark-coloured hairs near the middle. These resemble similar hairs in the brush of *A. whytei*, but they are fewer in number and much shorter. A little further from the base the brush-bag becomes deeply convoluted on its inner side and bears great numbers of small cells, from which arise delicate filaments similar to the "dust-hairs" in *A. niavius*. Pl. XI, fig. 2, is a photograph of a section across this area. In the latter species these dust-hairs, though numerous, are almost insignificant compared with their development in *psyttalea*. In the latter they form the most conspicuous feature of the brush, and are produced in enormous quantities. They arise from cells all round the brush-bag, and in section they form a dense ring enclosing the yellow pencil. Pl. XI, figs. 3 and 4, show the appearance of sections of the brush near the middle, and towards the outer end, respectively. The dust-hairs extend to the end of the brush, where they show the same tendency to break up into particles. From an area some little distance from the basal end of the bag there arise the black hairs similar to those in *niavius*. These can be seen in figs. 3 and 4.

The prolific production of dust material in *A. psyttalea*, as shown by microscopic examination, is interesting when considered in conjunction with Dr. Carpenter's observations on the courtship of the species. Dr. Carpenter's note was read by Prof. Poulton at the meeting of the Society on December 2nd, 1914, at which I exhibited photographs of sections of Danaine scent-organs illustrating the present paper. His remarks were as follows :—

"On July 21 [1914] at the edge of the forest here on Kome Island, about 5 p.m. I saw the courtship of *Amauris psyttalea*, Plötz. I noticed two flying about, obviously a male pursuing a female. Presently the latter settled on an erect dead flower-spike of an aromatic Labiate, about two feet above the ground. She sat with head upwards and body perpendicular, wings outspread at right angles.

* I have referred throughout to these hairs as the "yellow hairs," since they are of that colour in all my preserved specimens. As Dr. Carpenter, in the observation quoted below, speaks of them as "quite white" in the living insect, I conclude that they become yellow after immersion in preservatives.

The male hovered flutteringly about four inches over her head, rising and falling a little, but on the whole at about the same level. His abdomen hung down a little, and every now and then at intervals of a few seconds the two flaps [the male claspers, especially large in Danaines] at the end of the body were widely separated (so as to stand out at right angles to the long axis of the body), and the brush was quickly protruded and as quickly drawn in again. I was surprised to see what a large structure it was, being quite white and visible at a distance of several yards. In fact, I first noticed it at that distance and went closer to see what was going on. The female sat quite still except for an occasional slight movement of the wings. I watched for a minute or so, and it was impossible to doubt that the male was endeavouring to excite the female. Just as I thought I would catch them as records, the female suddenly flew away and the male followed. I have, however, no doubt of the species.

"The very sudden protrusion of the brush might easily cause the peculiar fine hairs of stellate section, described by Eltringham, to break into sections which would float like dust in the air."

There can be no doubt that the dust material plays an important part in the courtship of these insects. Pl. XI, fig. 5, is a photograph of a very small area of a slide which has been dusted with a brush taken from a dry specimen. The filaments which form the dust are very similar to those found in *A. niavius*, but in transverse section whilst presenting an irregular outline, appear less distinctly stellate. They arise from very deep sockets, and communicate with their respective hypodermal cells through fine canals which traverse the chitinous membrane of the bag. They seem not to break into such very short pieces as the *niavius* filaments.

Amauris egialea, Cram.

The structure of the wing-brands in this species differs in several details from that found in *A. niavius*. Pl. XVIII, fig. 3, shows the shape of the normal scales as compared with those found on the scent-patch. The latter, one of which is shown in the figure, are considerably elongated instead of rounded as in *niavius*; moreover, they do not closely cover the glandular area. Pl. XVIII, fig. 4, shows a semidiagrammatic view of a portion of the brand viewed

from above, from which it will be seen that the rows of scent-cups, indicated by dotted circles, are separated by glandular areas without cups, whereas in *niavius* there were no such intermediate rows. As a result of this formation, a transverse section of the scent-patch taken parallel with the general direction of the nervures has a quite different appearance from a section taken at right angles to this direction. Pl. XVIII, fig. 1, shows a section parallel with the nervures. On the upper wing surface the scent-cups are seen, each with its gland consisting of a few more or less vacuolated cells with prominent nuclei. The scales are rather thick and apparently solid. It should be noted that the glandular cells are short and do not reach to the ventral or lower wing-surface, thus leaving a space which is possibly filled with fluid during life. Alternating with these cupped glands are what may be termed " blind glands," formed of cells resting on a mass of material which is preserved in the section and presents a horizontally striated appearance. That this is really a mass of material, and not a membrane, is proved by the fact that its appearance is continuous in consecutive sections in whatever direction they may be cut. It presents the same appearance in sections cut in planes at right angles to each other.

Pl. XVIII, fig. 2, shows a section transverse to the nervures and through a row of the cupped glands. The difference in wing thickness is due to the section having been taken nearer to the edge of the patch. Also, the glands being somewhat flattened, they appear broader in this section. In all other respects the structure of the glands appears to be the same as in fig. 1.

The abdominal brushes are situated as in *A. niavius*, and are similar in so far as they consist of chitinous hairs arising from the lining of a membranous bag. They are everted by fluid pressure in the body cavity of the insect, and withdrawn by means of a muscle attached to the proximal end of the bag and to one of the ventral abdominal plates. The structure of the brush is, however, very different. When dissected out it is found to be of a fairly uniform thickness up to within about 1 mm. of the proximal end, where it is somewhat sharply constricted and, for the remainder of its length, considerably narrowed. From this constricted portion there arise structures which are very different from the well-rounded hairs more commonly found in these brushes. They are presumably in

a more primitive condition, resembling thick scales of irregular section and comparatively great length. They arise from cells with chitinous sockets quite similar in appearance to those giving rise to the other hairs or scales, but above the stalk they are abruptly expanded so that their mean diameter is much greater than that of the sockets from which they arise. The base of the brush is composed of these structures only, and in the retracted condition they form a central cone, lying in the heart of the brush and ending in a point at about two-thirds of the distance from the base of the brush to its extremity. These bodies readily take stains such as haematoxylin and carmine, and are not chitinised to anything like the same extent as other portions of the brush. Pl. XVIII, fig. 5, shows a section of one of these structures as seen under a very high power. It is evident that the shape is such as to increase as much as possible the surface area. Moreover, I am inclined to think, after careful examination, that numerous pores exist in the surface, so that it is reasonable to suppose either that some secretion is discharged therefrom, or that they serve as a store for the secretion extracted from the wing-glands. There is, however, no direct evidence of their function.

Pl. XII, fig. 1, is a photograph of a section of the brush, where it consists solely of these structures. The membrane of the brush-bag is here very thin and contains many small nuclei. Pl. XII, fig. 2, shows a section taken a little above the constricted portion of the brush. Here the outer membrane has become thicker, and the large nuclei are those of the ordinary hair-producing cells. Two new structures are now seen to have arisen.

(1) Forming a ring round the central bodies already described are structures whose walls are evidently thin, and present in section an irregular and considerably convoluted appearance. These bodies enclose and thicken the cone in the heart of the brush, dying out to a point a little nearer its distal end. A highly magnified section of one of these is shown on Pl. XVIII, fig. 6. Inside the thin wall is an exceedingly delicate tissue with distinct dots scattered through its substance, and showing a more or less radiate striation. The walls of these bodies do not show signs of the presence of pores.

(2) Outside these " first-ring " bodies we see the ordinary brush-hairs—not, at this level, very well rounded in sec-

tion, but still recognisable as corresponding to the hairs in the *niavius* brush. Pl. XII, fig. 3, is a section a little further towards the distal end. Here the central bodies occupy a reduced area. They are still surrounded by the first-ring bodies, but what may now be called the normal hairs occupy a greater space. It should be particularly noted in this figure that the outer layer of the normal hairs includes relatively many having a flattened section. Pl. XII, fig. 4, is a section still further outwards. The central bodies have almost come to a point, and are surrounded by a fairly thick mass of first-ring structures. The normal hairs, or "second-ring," occupying a large area, are those of the yellow tuft of the brush, corresponding with the yellow hairs of *niavius*. One of these hairs is shown in section at Pl. XVIII, fig. 7. The central lumen is small, the medullary substance presents a more or less radially striate appearance, and the outer surface is longitudinally ribbed.

(3) The black hairs have now begun to arise from the bag membrane. They are of variable diameter, and are separated from the yellow hairs by those of flattened section which occupied the extreme outer layer in fig. 3. We may call these the third-ring bodies. In Pl. XII, fig. 5, the central cone has finally disappeared, the first-ring bodies are coming to a point, whilst the normal hairs, yellow and black, occupy nearly the whole of the area. In Pl. XII, fig. 6 the normal hairs remain, divided, however, by the third-ring bodies, which are larger and flattened towards the end of the brush, and are here seen to be distinctly differentiated. In some species the hairs which thus become terminally flattened eventually break up into small fragments, and thus provide the "dust" which so frequently occurs in connection with these organs.

In *A. egialea* this breaking up does not seem to occur, nor do any of my sections show that dust is produced at all in this species.

The structure of the organs in *A. egialea* differs from that in *A. niavius* in the following manner. The cupped glands of the wing-patch are not continuous, but have rows of blind glands between them. The scales are of a different shape, and do not provide a complete protection for the cups. The gland-cells do not occupy the whole space between the wing-membranes, and those of the blind glands rest on a substructure which presents a horizontally

striated appearance. The brush does not consist solely of the yellow and black hairs, but is provided in addition with a core of curiously modified structures of which those occupying the centre are but little chitinised, whilst the yellow and black hairs are separated by a layer of bodies of irregular section extending to the outer end of the brush, where they become much flattened. There is apparently no apparatus for producing dust.

Amauris ochlea, Boisd.

In this species the wing-patch, whilst differing slightly from that of *A. egialea*, resembles it closely in its main features. The scales of the wing-brand are very similar in shape, and in the same way they fail to cover the glands. The cupped glands are in rows which, as in *egialea*, alternate with rows of blind glands. In section the appearance is also similar, but though the gland-cells are of about the same size, the whole wing-patch is somewhat thinner; hence in the cupped glands there is much less space between the cells and the underside of the wing; whilst beneath the cells of the blind glands there is but a trace of the horizontally striated tissue.

The abdominal brushes of *A. ochlea* are also very similar in structure to those of *egialea*. There is a core of central bodies surrounded by first-ring structures, and the black and yellow hairs are separated by a layer of third-ring bodies. These latter, however, are flatter near their origin, after which they become more rounded, and finally again flattened towards their extremities. These bodies, together with the yellow hairs, have, however, a different structure from those of *egialea*. Instead of being regularly striated their surface is studded by immense numbers of what may be termed chitinous nodules, which are very conspicuous both in transverse and longitudinal section, and towards the distal end of the brush undoubtedly become detached, forming a kind of dust which serves the same purpose as the dust produced in various ways by other species. Pl. XVIII, fig. 8, shows a transverse section of one of the hairs, whilst fig. 9 shows the appearance in a longitudinal view. Not only is the outer surface covered with nodules, but similar particles appear to be formed within the hair. It may be noted that these nodules are rather readily stained by haematoxylin. They

are not the dried granules of a secretion, since they are unaffected by prolonged immersion in eau-de-javelle, although particles of secretions which I have observed in other species, however fully they may resist the action of the various solvents used in preparing the sections, disappear more or less readily when a drop of eau-de-javelle is placed on the slide. The dust produced in this manner in *A. ochlea* must be very small in amount as compared with that formed in such species as *niavius* and *psyttalea*. I have not reproduced photographs of sections of the brush in *A. ochlea*, nor drawings of the wing-glands, since compared with the same organs in *A. egialea* the differences are so small as scarcely to warrant separate illustration.

Amauris hecate, Butl.

The wing-patch presents alternate rows of cupped and blind glands, as may be seen in Pl. XVIII, fig. 12, showing a section parallel with the nervures. The gland-cells differ considerably from those of *A. egialea*, in that they occupy nearly the whole space between the wing-membranes. The structure may be regarded as somewhat intermediate between that of *niavius* and *egialea*. The scales on the wing-patch, of which one is shown in fig. 10, are also intermediate in shape. They cover the glands very incompletely, though more effectively than those of *egialea*.

The structure of the brush in *A. hecate* is also of an intermediate character. Pl. XIII, fig. 1, shows a section near the base, from which it may be seen that there is a small core of modified scales presenting in large part the characters of both the central and first-ring bodies of *egialea*. These die out rapidly and the greater part of the area of the section is taken up by the yellow hairs, as shown in Pl. XIII, fig. 2, in which will also be noticed, on the side, where the bag membrane is thinnest, a somewhat obscure mass, unfortunately not very clearly in focus. This represents certain flattened hairs which arise on that side and become at higher levels (figs. 3 and 4) somewhat invaginated on one side so as to present a reniform section. These structures may perhaps be regarded as corresponding with the third-ring bodies of *egialea*. In fig. 4 they occupy a large area of the section and are obviously tending to break up, a condition shown still better in fig. 5. They arise from cells in the bag membrane, and in longitudinal

section are not at first distinguishable from the yellow hairs. They soon, however, begin to present a nodulated appearance similar to that in *ochlea*, and their disintegration towards the distal end of the brush produces a considerable quantity of dust corresponding with that of other species. It will be noticed from the sections that the black hairs in this species are of comparatively small diameter, and that they arise from an area of the brush-bag which is greatly thickened by the aggregation of small trichogenic cells. Pl. XIII, fig. 6, is a longitudinal section of this area. Pl. XVIII, fig. 13, shows a section of a yellow, and of a black hair, and fig. 11 represents the appearance of one of the flattened and nodulated hairs which ultimately break up to form the dust material. This disintegration occurs through the gradual decrease in the lumen and the thinning down of the bases of the nodules, until the latter become detached. A longitudinal view of one of these hairs presents much the same appearance as that of the corresponding structure in *A. ochlea*.

Amauris whytei, Butl.

The wing-patch in this species is provided with scales which closely resemble those of *A. egialea*, both in shape and in the fact that they do not form a continuous protection for the upper surface of the glands. The structure of the wing-patch differs from all those previously described in not showing any definite differentiation into separate glands. The cup-like structures occur in fairly definite rows, separated by rather wide spaces representing the blind-gland areas described in other species. It will be seen from the section shown on Pl. XIX, fig. 14, that the glandular area is very thin and that the gland-cells are rather irregularly placed between the wing-membranes. Strands of connective tissue joining the two surfaces of the wing presumably exist, although they are but little evident. In this species the wing-patch is either in a more primitive condition or is, so far as thickness and differentiation of structure are concerned, degenerate.

The abdominal brushes are also in some respects different from those already described. Pl. XIV, fig. 1, shows a section of the brush near its base. The brush-bag is seen to be comparatively thick. Large hair-producing cells are present, and in at least two instances the central lumen of

these is plainly visible. The first to arise are the small dark-coloured hairs seen near the middle of the section. These form a core continued throughout the length of the brush, and, unlike the components of the core in the *egialea* brush, are heavily chitinised from their origin. Surrounding these are hairs of large diameter, less chitinised, and corresponding with the yellow hairs of other brushes described. The remainder of the section is seen to be occupied by hairs of relatively small diameter and less distinct outline. These at their origin are scarcely distinguishable from the yellow hairs, though they soon become differentiated by their granular appearance. In Pl. XIV, fig. 2, the black hairs have begun to appear at one side and the cuticle of the brush has become thin. Figs. 3 and 4, representing the same structures at higher levels, show an increasing diameter in the hairs of the core. In fig. 5, still higher, the black hairs have become less numerous and those of the core smaller, whilst the granulated hairs now betray their purpose as dust producers, breaking up and forming small nodules as in *A. ochlea*. Fig. 6 is a section taken still nearer the end of the brush. The black hairs have nearly died out, the core hairs are much reduced in diameter, and the dust hairs are continuing to disintegrate. On Pl. XIX, fig. 15, I have endeavoured to show the appearance of one of the yellow hairs as seen under a high power. The outline is very irregular, and the wall seems to be pierced by minute pores occurring here and there, not on the longitudinal ribs, but between them. I am not really certain of the existence of these pores, but careful examination of sections strongly suggests their presence. On Pl. XIX, fig. 16, I have shown one of the granulated hairs as it appears when breaking up. In a section taken near the end of the brush the whole field is strewn with the separated particles.

The principal peculiarities of the scent-organs in *A. whytei* are, then, the thin and simplified wing-patch, and the central pencil of fine stiff hairs in the brush.

So far the organs examined have all been taken from species of one genus, viz. *Amauris*. It will now be profitable to investigate the structure of the scent-apparatus in other Danaine butterflies.

As an example of a small but important genus we may take **Tirumala petiverana,** Doubl.

In this genus the alar scent-organs do not form a patch,

but consist of a fold or pocket of the wing. As the brushes are of a less complicated structure than the scent-pocket, it will be convenient to describe them first. They consist of the usual membranous bag from which arise the hairs of the brush, which in this species are all of one form and strongly chitinised. It is unnecessary to give a photograph of more than one section of the brush. Pl. XV, fig. 4, represents the general appearance of any transverse section of that organ, whilst Pl. XIX, fig. 23, shows one of the hairs in section as seen under a high power. I am inclined to think that these hairs are pierced by minute pores. At any rate a very thin section shows a number of pale radial lines between the low ridges which longitudinally traverse the surface. Within the hair-wall is a delicate medullary substance pierced by a longitudinal canal of irregular section, and often of very eccentric position. Pl. XIX, fig. 21, shows a longitudinal surface view of one of these hairs. The structure is very faint, and only visible under a high power, which shows that the fluting or ribbing is not, at least, in the greater part of the hair parallel with the long axis, but takes an undulating course. With regard to the presence of pores in these hairs, it is curious that their existence should be rather strongly suggested in a species in which their utility is least obvious, for the production of a scent-secretion as well as of a dust material appears, as will be seen later, to be amply provided for by the wing-pocket. One other feature remains to be noted. A considerable portion of the interior of the brush-bag, especially towards the open or distal end, is not smooth as in most of the other species examined, but thrown into a great number of minute irregular folds, giving it on a surface view the appearance of being covered by a mass of tiny excrescences. This feature, which is not accompanied by any glandular development, occurs also in *Danaida chrysippus*. So far its significance is obscure.

Pl. XV, fig. 5, is a photograph of a section of the scent-pocket in *T. petiverana*. It consists of an outer chitinous layer bearing large scales, and morphologically part of the underside of the wing. Next to this is a layer of irregular cells, followed by a second layer, from which arise the small dark scales seen in the photograph. Within the cavity of the pocket masses of thread-like bodies may be seen lying loose. Pl. XIX, fig. 19, shows more accurately the structure

of the various layers of the pocket. The inner layer exhibits numerous vacuolated cells more or less separated by strands of chitinous material, and associated with scale-sockets from which arise the scent-scales. These are in the form of flattened elongated bags, having a central cavity which almost certainly opens by a pore at the outer end of the scale. Beneath this layer is a second stratum of cells also showing large vacuoles. This layer is highly developed at the closed end of the pocket and becomes greatly attenuated towards the mouth, where it opens on the upper surface of the wing.

It seems convenient here to refer to the notes of Mr. J. C. Kershaw on the structure of the scent-pocket in the very closely allied species *T. limniace*, occurring in the Oriental Region. Mr. Kershaw made, but did not publish, numerous observations on the scent-glands and genital apparatus in certain Oriental Danaines, together with some excellent line drawings. The notes and drawings were handed over to Prof. Poulton at Oxford, and I have his and Mr. Kershaw's kind permission to make use of them. Speaking of *limniace* he says :—

" The interior of the pocket or sac on the underside of the hind-wing (with the opening thereto on the upper side of the wing) is lined with scales entirely different to those overlying the rest of the wing. These scales are bottle-shaped and filled with fluid, but I was unable to detect any special scent. Many of these scales are reduced to powder which lies in the cavity of the sac."

In a subsequent note the same author says :—

" The oily nature of the scent-scales, or rather the oily nature of the liquid contents of the flask-shaped scent-scales, is easily seen when a batch of scales is scraped off and crushed on a slip under a moderate power; or if a single scale is crushed with a needle under a fairly high power, especially if a drop of water is placed on the slip, when the liquid from the scent-scales behaves exactly like oil, floating on the surface in minute globules. The scent-scale liquid is also greasy to the touch, but, of course, a large batch of scales must be crushed to get enough material to test by touch."

The above observations were, of course, made on fresh examples, and my specimens, which had been treated with preservatives and then kept in spirit, do not show the oily contents of the scales. Mr. Kershaw's notes are therefore

of the greatest value in enabling us to learn something of the function of the scent-pocket. We may, I think, fairly assume that the vacuolated cells form the glands which produce the oily secretion, and that this is accumulated in the scales and discharged thence into the wing-pocket. There remains then the dust material which occurs in such large masses in the pocket, and can also be observed entangled in the hairs of the anal brush. I was for some time at a loss to discover the true origin of the dust filaments. In my sections of the scent-pocket they were invariably found loose in the cavity and already much broken up. I found the same substance, but in a still more disintegrated condition, amongst the hairs of the abdominal brush. In the brush there was no evidence of dust production, whilst its presence in larger quantities and in a less pulverised condition in the scent-pocket strongly suggested the latter as its place of origin. Probably the truth of the matter would still have remained a mystery, but for my having been fortunate enough to secure, through the kindness of my friend Prof. Poulton, a pupa of *T. limniace*, the oriental form of this species, in which the imago was almost completely formed. The specimen had been sent to the Hope Department from Ceylon by Lieut.-Col. N. Manders. The pupa was not preserved in any way, being merely dried, and I had small hope that sections of any value could be cut from it, but the inspiring optimism of my friend above mentioned was quite justified. A prolonged evaporative embedding in celloidin resulted in my being able to cut sections which revealed the highly interesting fact that the dust filaments are produced beneath the pupal covering, and that, by the time emergence takes place, the cells from which they arose have become practically atrophied. The examination also showed that up to the time of emergence there is *no scent-pocket at all.* The area which subsequently becomes a pocket is, as in the *Amauris* imago, a patch on the hind-wing. In *Tirumala*, however, the expansion of the wing after emergence causes an invagination of the patch, which thus becomes a pocket. In dissecting out the wing from the dried pupa already mentioned I found that the patch was covered with a rather thick mass of material, which in its dry state scaled off and fell to pieces at the least touch. This substance mounted in clove oil proved, as was expected, to

be entirely composed of the dust filaments, some of them being of surprising length. They break with such facility, and are so inextricably interwoven, that it was impossible to separate out a single filament. Pl. XV, fig. 6, shows a photograph of a few particles lying at the edge of a mass of the material, whilst Pl. XIX, fig. 22, shows small pieces of the filaments as seen under a high power. Pl. XIX, fig. 20, shows a section of the dried wing before emergence from the pupa. Cell structure is of course absent, as the soft parts have not been preserved, but sufficient remains to show that in the unexpanded wing, the scent-patch, as it then is, contains cells which produce the filaments, forming a mass of dust material, the latter becoming enclosed in the pouch as it is formed by invagination. The little filaments shown in fig. 20 are merely the unbroken basal ends of threads of much greater length. Careful examination of many sections leads me to suppose that the cells which produce these filaments alternate with those which give rise to the scent-scales. The thread-producing cells cannot be recognised in the imaginal wing, and I can only suppose that, having produced the dust material, their function ceases and they become crowded out by the increased development of the vacuolated oil-producing cells.

In *T. petiverana* we have therefore a curious contrast with the structure in *A. niavius*. Instead of the dust material being produced in the brush, it is formed by the wing-patch, although only by that organ in the pupal state.

Danaida chrysippus, Linn.

So much is now known of the bionomics of this abundant species that it is interesting to be able to add something to a knowledge of its structure. The male possesses a small scent-pocket in the hind-wing and the usual pair of abdominal brushes. The scent-pocket is not formed quite like that of *T. petiverana*, since it is really a projection from the wing surface subsequently folded over to form a kind of recess. Thanks to my friend Lieut.-Col. Manders, I have been able to make preparations from the pupa of this species, sent to me in a properly preserved condition, so that something of the final development of the scent-organs has been disclosed.

The brush contains hairs of one kind only and of simple

structure. Both transverse and longitudinal sections show that there are, entangled in the hairs, large numbers of minute spherules—apparently a coagulated secretion. They are certainly not chitinous particles of dust material, since they dissolve fairly readily and not slowly in eau-de-javelle. From the appearance of these granules in a longitudinal section, one is tempted to believe that they are extruded from the hairs themselves, since they adhere thereto very closely in many places. The absence, however, of any glandular structure in the cells of the brush-bag lends greater support to the theory that they are in fact a product of the secretion produced in the wing-pocket. The brush-hairs are round in section for part of their length, but become much flattened towards their distal extremities. Pl. XIX, fig. 26, shows a section of one of these hairs; fig. 27 a longitudinal surface view. The surface of the hair is seen to be traversed by longitudinal curved ridges, each of which bears two rows of small projections arranged alternately on each side of the crest. As in *T. petiverana* there is no pocket in the unexpanded wing, but the portion which afterwards becomes invaginated consists of a diverticulum. Pl. XVI, fig. 1, is a photograph of a section of a wing before emergence. On the right may be seen the outgrowth from the wing-surface covered on its outer side by a layer of small thick scales. The double row of delicate structures in the centre of the section represents the ordinary scales of the upper surface of the wing. Pl. XX, fig. 28, is a drawing of a small portion of that part of the unexpanded wing which will form the scent-pocket in the imago. The cells which produce scales are highly vacuolated, and alternate with cells attached to cup-like projections somewhat similar to those already described in other species. The cup-cells at this stage seem mainly to produce those long processes described by Mayer,* which ultimately form the fibres holding together the upper and lower surfaces of the wing during expansion. Nevertheless some of them ultimately develop into cells which appear to differ but little from those attached to the scale-sockets. The cause of the folding in of the diverticulum during expansion may be easily discerned by comparison with Pl. XIX, fig. 25, which shows in section a part of the ordinary unexpanded wing-membrane. Here the chitin is thrown into deep folds which

* Bull. Harvard Mus., vol. xxix, p. 209 *et seq.*, 1896.

will become flattened during expansion. The patch is already flat, and being incapable of extension, becomes covered by a fold. Pl. XIX, fig. 24, shows a cup and a socket-cell from the imaginal wing. These cells are highly vacuolated, finely granular, and occasionally provided with more than one nucleus, especially the socket-cells. Mayer (*loc. cit.*) describes the nuclei of the scale-producing cells in the wing of *D. plexippus* as occasionally undergoing amitotic division, so that we may suppose this process also to take place in the present species (a broken scale is shown arising from the right-hand cell). The "cups" have no relic of a scale-stalk as in *D. lotis*, but appear to possess a central pore, though this is scarcely so obvious as in some species of *Amauris*. The scales lining the pocket have an appearance which suggests that they are traversed by pores, though the structure is less easily discernible than in *lotis*. There is no evidence in either pocket or brush of the production of any dust material.

A longitudinal section of the brush within the pupa shows the hairs arising from highly vacuolated cells, each with a large nucleus. The cytoplasm is finely granular, and stains less readily towards the extremity from which the hair arises.

Danaida lotis, Cram.

In this species there is a fold in the hind-wing resembling that of *D. chrysippus*, and a pair of abdominal brushes, the latter presenting no special features. The hairs are of one kind and strongly chitinised. In general their sections resemble those of *chrysippus*, and small spherical particles of a dried secretion may be observed entangled amongst them. Some hairs are flattened for a portion of their length or depart in other ways from the more truly circular section usually exhibited. Their functions are probably merely mechanical. Pl. XVI, fig. 2, is a photograph of a section of the brush not far from the distal end. Pl. XVI, fig. 3, shows a photograph of a transverse section of the wing-pocket, which is seen to be a more or less spiral fold of the wing. The pocket contains no dust material, and as none is found in the brush it is evidently not produced in this species. A surface view of the membrane with which the pocket is lined shows that alternate scale-sockets are modified into structures resembling scent-cups, whilst the remaining sockets present a more or less normal

appearance. A section through a portion of the pocket is shown at Pl. XX, fig. 29. The cupped glands contain a comparatively small cell, finely granular and possessing a large nucleus. From each arises a delicate projection which is doubtless a degenerate scale. From each unmodified socket arises a scale, and they are sufficiently numerous to form a complete lining to the pocket. These scales are porous, the minute openings lying along the striations of the surface mainly in the central area of the upper side. In connection with each scale is a large cell, the upper part of which is densely packed with large and conspicuous granules having a deep brown colour in unstained examples. These coarse granules usually obscure the nucleus which is also present in the upper half of the cell. They do not dissolve in ether, alcohol, or xylol, and are only very slowly affected by eau-de-javelle. The remainder of the cell is occupied by a delicate and highly vacuolated reticulum, presenting a finely granulated structure. Whether the hair-like vestigial scales arising from the cupped cells are open tubes or not I have been unable to decide. The covers of the cups have, however, rather the appearance of being minutely perforated, though this point is also extremely difficult to decide.

It should be noted that the structure described above, in so far as it consists of special scales alternating with delicate stalks, is similar to that described by Müller as occurring in *D. erippus*.*

Parantica eryx, Fab.

This species bears on the hind-wing a scent-patch of considerable size and presenting a somewhat pear-shaped outline. In surface view it shows regular rows of scent-cups alternating with normal scale-sockets from which arise scales much resembling those of *Amauris niavius* in shape, though rather larger. They form a continuous covering for the scent-patch of which a section is shown at Pl. XIX, fig. 17. Perhaps the most striking features of the patch are its comparative thinness and the large number of nuclei observed in each gland. In some cases I have counted as many as seven. Whether this number indicates the presence of seven cells, or whether some cells have more than one nucleus, has not been determined. There

* See my previous paper, Trans. Ent. Soc. Lond., p. 403, 1913.

are no intermediate or blind glands. The portion of the patch from which the drawing is made represents its maximum thickness. A considerable area is not any thicker than the rest of the wing, the upper and lower membranes being in close juxtaposition, and the glands so reduced as to occupy merely the interior of the scent-cup projecting from the upper-wing surface. The brush is of simple structure containing but one kind of hair. Pl. XV, fig. 1, is a reproduction from a photograph of a section of the brush near the base of the bag, showing that the sections of the outer hairs are not circular but irregular in outline. Fig. 2 represents a section taken at about the middle of the brush, and fig. 3 one near the end. In the latter it will be observed that the hairs have rather obscured outlines, due to the fact that they produce a certain amount of dust material by the breaking off from their surface of small projections. Pl. XIX, fig. 18, shows a longitudinal view of a portion of one of the hairs bearing small leaf-like projections which readily break off, and thus form detached particles. The dust produced is of very small volume.

Trepsichrois mulciber, Hubn.*

The scent-organs in this species consists of a pair of abdominal brushes and perhaps a large patch of special scales near the costa of the hind-wing, though in the case of the latter there is some reason to suppose that, if it has to do with the scent-apparatus at all, the function is mechanical. As compared with the brushes in the species already described, those of *T. mulciber* differ in their distinct connection with the actual seat of production of the scent. The brush-bag differs from that of the only other related species which I have been able to examine, in being provided with a peculiar accessory vessel at its base, though I would at once state that I have unfortunately had only a single example from which to make preparations, and the possibility, however remote, must be borne in mind that this structure may have been an abnormality. When dissecting out the brushes this accessory vessel became visible to the eye and appeared as a small vesicle attached to the proximal end. Pl. XVI, fig. 4, represents a photograph of a longitudinal section passing through the vesicle; fig. 5 a transverse section at the point where the vesicle

* Better known as *Euploea midamus*.

opens into the base of the brush-bag proper, in which latter a few of the hairs can be seen cut across. Fig. 4 shows that the vesicle consists of an outer layer of cells with conspicuous nuclei. From these cells arise narrow funnel-like structures somewhat chitinised and homologous with hair-sockets. From these, again, spring very delicate tubes of irregular section which more or less fill the cavity. Pl. XX, fig. 31, shows one of these funnel-sockets arising from the deep layer of vacuolated cells, the latter being partly seen in section. The delicate tube arising from the socket bulges out and overhangs the latter. The socket shows a core of cytoplasm which, judging from stained preparations, appears to divide at the distal end. The whole structure strongly suggests that some secretion is discharged from the funnel-sockets into the vesicle, through the delicate tubes, and passes thence into the cavity of the brush-bag proper. Pl. XVI, fig. 6, represents a photograph of a longitudinal, and Pl. XVII, fig. 2, a transverse, section of the brush-bag. The latter is distinctly glandular, many more cells being present than are found in species of *Amauris*. The hair-sockets are long and more or less funnel-shaped as in the vesicle, though somewhat less constricted at the middle of their length. Pl. XX, fig. 30, shows one of the hair-sockets under a higher power. Several cells are seen to form a basal gland in connection with a single hair, and at one side appears the lumen of a trachea, many of which are found in intimate connection with the brush-bag in this species. Pl. XX, fig. 32, shows a transverse section of one of the brush-hairs at a point towards its extremity, whilst fig. 33 represents the appearance of a longitudinal view of the same portion of the same hair. Near their origin and for a considerable portion of their length these hairs are either comparatively smooth or only faintly striated, but towards the distal extremity they develop more of less regular lines of projections. I have been unable actually to see pores in these hairs, but that there are openings to the exterior seems a reasonable conclusion from the glandular nature of the brush-bag. One other point should be noticed. The wall of the bag is glandular and gives rise to hairs along nearly its whole length, so that the appearance on eversion must be that of a test-tube-brush instead of a spherical tuft as in *Amauris*. I have found no evidence of any dust-apparatus in this species.

We have now to consider the special area on the hind-wing. On the upper side, extending over a large portion of the discoidal cell, and from the third median to the sub-costal is an area covered by long scales which give it a furry appearance. One of these scales is shown at Pl. XX, fig. 34*a*. It consists of a long narrow section culminating distally in a spatulate formation which bears numerous small hair-like projections. In the discoidal cell of the hind-wing there is in addition a somewhat quadrate patch of greyish brown scales, which also differ from those covering the rest of the surface. One of these scales, also shown at Pl. XX, fig. 34*b*, is seen to be broad, with a length of about three times the width, and apparently somewhat thickened in the central area.

The function of these specialised scales is obscure. They are supposed to be, and possibly are, scent-scales, though sections through the wing at points where they occur do not show any special cells, or indeed any cells at all, in connection therewith. If the insect can by any means transfer scent material from its brushes to the fur patch, the latter might serve as a distributing apparatus, but we require greater knowledge of the living butterfly in its natural surroundings before the function of these patches can be established. Kershaw mentions the species in the notes above referred to, and of the use of the brushes he speaks as follows :—

" Whilst flying up and down some shady pathway the butterfly often everts and retracts the glands, sometimes partially and sometimes fully : both when solitary and when in company with others of its kind. I could never be quite certain that the glands emitted any scent, though doubtless they do so. A powerful odour which would attract the attention of an insect might, I suppose, be imperceptible to human olfactory organs. In any case, the bright golden hairs of the glands are plainly discernible many yards away as the insect is constantly thrusting the glands out and withdrawing them."

The only other Euploeine butterfly I have examined is **Tronga brookei,** Moore. This species has no brands or patches of special scales on the wing, and the brushes must therefore perform their scent-producing functions unaided. I have not thought it necessary to photograph any of the sections, as they could scarcely be distinguished from those of *T. mulciber.* The brush-bag possesses the same glandular

structure, though the hairs are far more irregular in transverse section. Whether owing to actual divergence in structure or to some difference in the condition of the specimen or method of preparation, the hairs in longitudinal view seem to show their structure more distinctly than in *T. mulciber*. Over a large part of their length they are covered with projections, the form of which I have endeavoured to show in Pl. XX, fig. 35. There is no dust-apparatus and no accessory vesicle attached to the brush-bag.

Hestia lynceus, Drury.

The species of the genus *Hestia* do not possess either scent-patch or pocket on the wings. They are, however, remarkable in having four abdominal brushes instead of two. Whilst the purpose of this modification is obscure, its origin is at least suggested by the condition of the brushes in such a species as *Amauris niavius*, where a separate tuft of stiff black hairs arises from a limited area of the brush-bag. The auxiliary brush in *Hestia* seems to represent a modification of this special tuft lying in a separate bag. It lies parallel with the main brush and rather above it. It is much shorter and more slender, the basal end being less deeply placed in the abdomen. It is of simple structure, contains but one kind of hair, and the containing bag appears to have a slightly glandular structure confined to one side. Pl. XVII, fig. 2, shows a section of one of these brushes beyond the glandular level of the bag. Near their origin the hairs are occasionally invaginated along one side, giving the section a reniform appearance. Under a high power the hairs present a close resemblance to those of the larger brush in the same species. Pl. XVII, fig. 3, shows a section of the large brush, close to the basal end. It will be observed that the brush-bag is formed of a mass of small cells, differing entirely in appearance from those found in the same situation in species of *Amauris*, but resembling the glandular cells in the brush-bag of *T. mulciber*. Pl. XVII, fig. 4, is a section taken rather further from the base, and shows much the same structure, which continues for some distance (fig. 5). Finally, the glandular structure disappears and the bag towards its mouth becomes a mere membrane (fig. 6).

The hairs of which the brush is composed, though well rounded at their origin, become somewhat flattened and

of irregular section towards their distal extremities. Some hairs contain particles of a brown secretion, which appears in the photographs as a blackening of the section. Pl. XX, fig. 38, is a section of one of the hairs at about the middle of its length, showing the contained granules, whilst fig. 39 taken nearer the distal end is without these. Fig. 37 is a surface view of one of the hairs somewhat beyond the middle of its length. The hair is covered with projections having a curious form, their outer surfaces bearing delicate ridges and their extremities produced to fine points. Pl. XX, fig. 36, shows the appearance of the glandular cells of the main brush-bag. It is scarcely possible to decide how many cells belong to each hair-socket. Possibly the number may vary. I have here shown three, since in the preparation from which the drawing was made three cells could be recognised with some certainty as attached to this particular socket. Beneath the entrance of the hair is a rod of protoplasm usually staining rather darker than the rest, and surrounded by vacuoles. The cells are very finely granulated and contain large and conspicuous nuclei. There is no dust material in *Hestia lynceus*. The absence of wing-glands and the glandular structure of the brush indicate that the scent-material is produced by the latter, being apparently secreted by the cells and discharged into the interior of the hairs. Thence it must make its way to the exterior, and doubtless openings exist, although I have not been able to discern them. It is possible that the passages, which must be very minute, may be hidden by the projections on the hairs.

Summary.

In the foregoing pages I have endeavoured to describe as concisely as possible the actual structure of the remarkable organs associated with the production of scents in a few species of tropical butterflies. It may be objected that in no case is there any direct evidence that a scent is produced at all. Such evidence cannot, however, be expected from examples which, for histological purposes, have been subjected to the chemical action of preservatives. It is furthermore to be admitted that Mr. Kershaw working in the field could detect no actual scent in *T. mulciber*. Nevertheless, we know from the observations of Fritz Müller, Dixey, Longstaff, and others that very many Lepidoptera do produce scents perceptible to the human

olfactory organs, and further that such odours can be definitely associated with wing-brands, tufts, scales, and other specialised portions of the anatomy of these insects. In the case of the Danaine brushes and brands we can have no doubt as to the function, or the association of that function with sexual purposes. Throughout the animal kingdom we are familiar with an infinite variety of elaborate devices providing for the continuance of the species, and in insects the olfactory sense seems pre-eminently chosen as the agent whereby the species may attract and find its mate. Perhaps the most remarkable feature of the organs here described is the elaborate development of friable hairs producing quantities of dust which almost certainly plays a very important part in the distribution of the scent, an interpretation strongly supported by the observed behaviour of *A. psyttalea*, and it is further remarkable that the dust may arise from either the brush or the wing according to the species. As I pointed out in my previous paper the dust material is no new discovery. The late Dr. Fritz Müller, whom little seems to have escaped, described such hairs in the wing-folds of Hesperidae and called them "chain-bristles," since they took the form of long hairs constricted at regular intervals and liable to break at each constriction. My friend Mr. A. H. Hamm has lately called my attention to large masses of yellow "fluff" occurring on the hind-wing of the male moth *Erebus macrops*. I find this to consist mainly of "chain-bristles" of an exceedingly beautiful form.

The studies described in the present paper show how a modest equipment of technique applied to suitable material may disclose much that is interesting in the mere structure of the organs in question, but of their physiology we know little or nothing. If the simple brush of *D. chrysippus* can perform its function efficiently what is the significance of the five different structures found in the complicated brush of *A. egialea*? The granules in the wing-cells of *D. lotis* are not of the same chemical nature as the secretion granules subsequently deposited in the brush. In what does the change consist? Do some of these brushes secrete a substance which combines with another stable compound provided by the wing patch to form a volatile oil? In *A. niavius* the wing-glands are neatly covered by a layer of scales which seem precisely adapted for the purpose of protection. Hence we might suppose that the

secretion of the wing is easily evaporated and must be protected, yet in *A. egialea* the scales cover the glands so imperfectly as to be probably useless for such a purpose.

It is to be feared that the study of the chemistry of these secretions is only possible in those countries where the insects may be obtained in large numbers and in fresh condition. Meanwhile I would proffer one or two suggestions to those collectors abroad who may take an interest in the subject. In detecting delicate odours and locating their origin it would seem that some success might be attained by using a glass tube one end of which would fit the human nostril the other being drawn out to a comparatively narrow diameter. The narrower end being applied to suspected centres of emission the odour might reach the human olfactory epithelium in a less diluted form than it necessarily does under ordinary circumstances. Furthermore, a number of crushed wing-brands might be placed in a small phial and warmed so that the scent might become sufficiently concentrated to be perceptible. Again, assuming a plentiful supply of material, might it not be possible to apply the principles of perfume manufacture to the extraction of any scent that may be present in certain organs? Large numbers of the scent-brands of some common species could be crushed and mascerated with a very small quantity of clarified lard and the product distilled with alcohol.* Or by means of a tube with a tightly fitting screw, and a minute aperture at one end, an appreciable quantity of the scent material might be expressed from a mass of the brands.

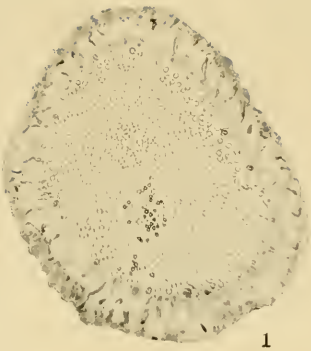
Finally, whilst fully recognising the excellent contributions already made to our knowledge of the subject by the authors mentioned in the course of this paper, it would seem that there still remain opportunities for comprehensive researches covering an interesting field, which it is to be hoped will attract the attention of our many capable workers in the tropics.

* Dr. Dixey has already shown that in the case of certain Pierines there may be made from the wings an alcoholic extract possessing the characteristic odour of the species from which it was prepared. See Proc. Ent. Soc. Lond., p. lix, 1905.

Explanation of Plates XI–XX.

[*See Explanations facing the* Plates.]

June 26, 1915



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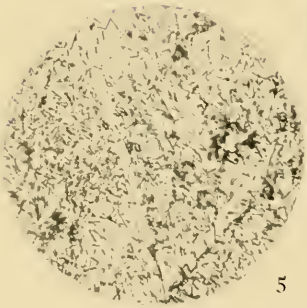

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AMAURIS PSYTTALEA, BRUSH, &c.

Explanation of Plate XI.

Fig. 1. *Amauris psyttalea*. Section of brush near base of same showing "yellow" hairs, thick cuticle and a few fine stiff hairs in centre.

2. ,, ,, Section at origin of dust hairs showing modification of cuticle where these arise.

3. ,, ,, More distal section, showing black hairs arising, and "yellow" hairs surrounded by dense mass of dust hairs.

4. ,, ,, Portion of a section still nearer distal end. Black hairs are now more numerous.

5. ,, ,, Small area of a slide showing dust produced by breaking up of dust hairs.

(All × 50.)

Explanation of Plate XII.

Fig. 1. *Amauris egialea.* Section of brush near base showing central bodies.

2. „ „ More distal section. Central bodies are now surrounded by "first ring" structures, and these again by the "yellow" hairs.

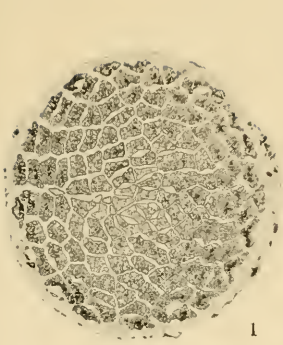
3. „ „ Ditto. Outside the "yellow" hairs, structures of irregular section can now be seen.

4. „ „ Ditto. The central bodies have almost disappeared. The black hairs are now arising separated from the "yellow" hairs by those of irregular section seen in section 3.

5. „ „ Ditto. The "first ring" structures are now disappearing.

6. „ „ Ditto. The black and yellow hairs remain, separated, however, by the irregular structures already referred to.

(All × 50.)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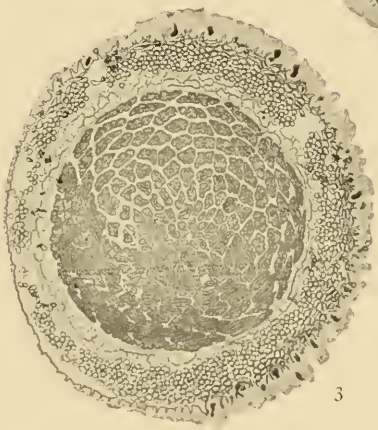
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AMAURIS EGIALEA, BRUSH.

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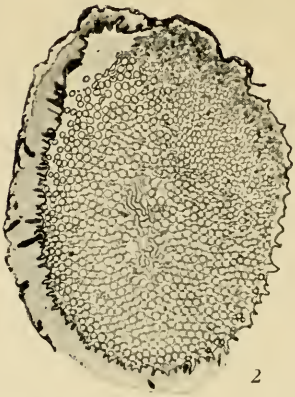

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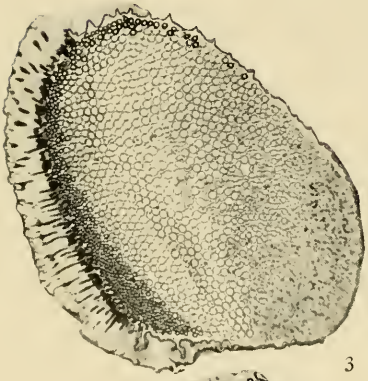

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AMAURIS HECATE, BRUSH.

Explanation of Plate XIII.

Fig. 1. *Amauris hecate.* Section of brush near base. Central bodies, surrounded by "yellow" hairs, are seen.

2. ,, ,, More distal section. Central bodies have almost disappeared. At upper right side are seen rather indistinct structures. These are the hairs which ultimately form the dust.

3, 4, 5. ,, ,, Further sections showing the arising of the black hairs and the development of the dust hairs, many of which, in figs. 4 and 5, show a reniform section.

6. ,, ,, Longitudinal section of cuticle of brush bag at origin of black hairs.

(All × 50.)

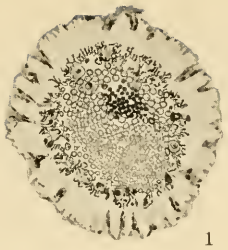
Explanation of Plate XIV.

Fig. 1. *Amauris whytei*. Section of brush near base. Note central core of stiff fine hairs.

2. „ „ More distal section. Central core continued, and black hairs arising.

3-6. „ „ Further sections showing gradual development of the granulated or dust-producing hairs.

(All × 50.)



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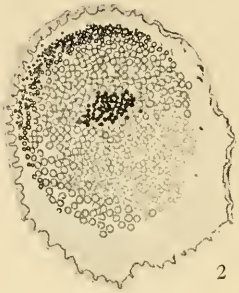

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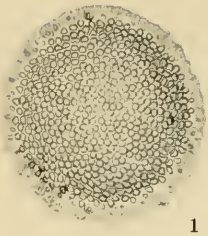
AMAURIS WHYTEI, BRUSH.



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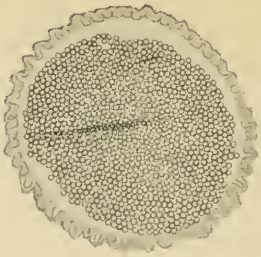

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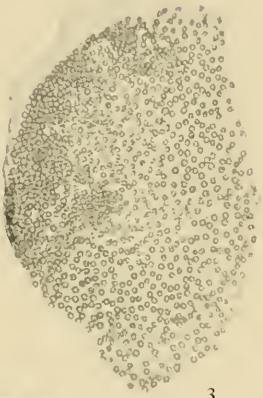

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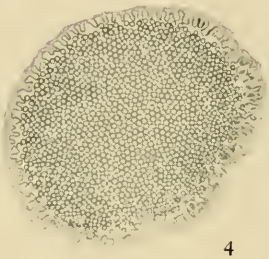

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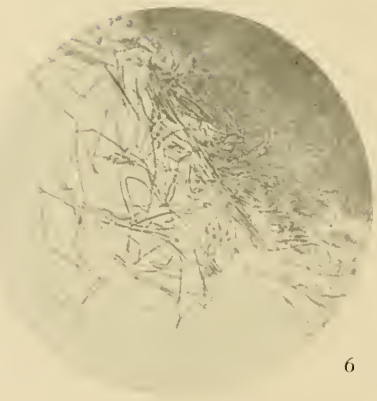

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P. ERYX AND T. PETIVERANA, BRUSHES, &c.

Explanation of Plate XV.

Fig. 1–3. *Parantica eryx.* Sections of brush. In this species the brush contains but one kind of hair. (× 50.)

4. *Tirumala petiverana.* Section of brush. There are no complications in this species, and any section shows much the same appearance. (× 50.)

5. , ,, Section of scent pocket of wing showing contained dust material. (× 75.)

6. ,, ,, Dust material from wing pocket. (× 75.)

Explanation of Plate XVI.

Fig. 1. *Danaida chrysippus.* Section of wing before emergence from pupa. On the right is the diverticulum which, when invaginated after emergence, forms the scent pocket. (× 75.)

2. „ *lotis.* Section of brush near distal end. The dark spots here and there are particles of a dried secretion. (× 50.)

3. „ „ Section of wing pocket showing its spiral formation and deep glandular cells. (× 50.)

4. *Trepsichrois mulciber.* Longitudinal section through accessory vesicle of brush bag. Note epithelium with many nuclei and funnel-like sockets from which arise delicate membranous tubes. (× 50.)

5. „ „ Transverse section at base of brush bag. At lower right-hand side is seen passage from same to accessory vesicle. (× 50.)

6. „ „ Longitudinal section at base of brush bag showing glandular cells and funnel-shaped sockets of hairs. (× 50.)

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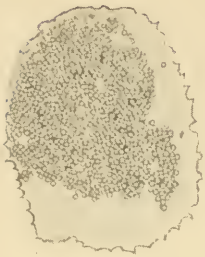

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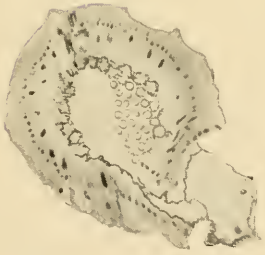

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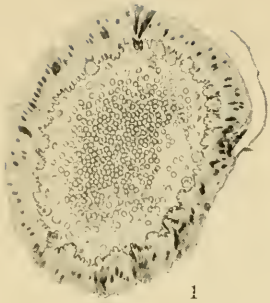
DANAINE SCENT-ORGANS.



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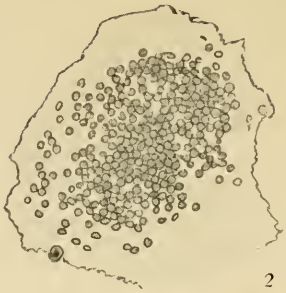

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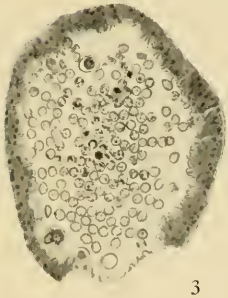

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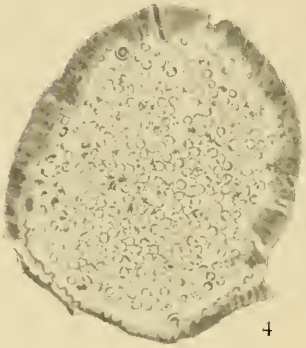

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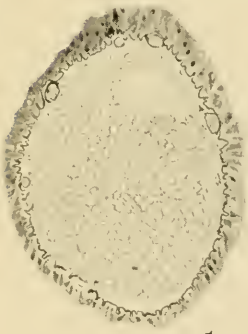

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DANAINE SCENT-BRUSHES.

Explanation of Plate XVII.

Fig. 1. *Trepsichrois mulciber.* Transverse section of brush bag, corresponding to the longitudinal section shown at Pl. XVI. fig. 6.

2. *Hestia lyncaeus.* Section of small brush.

3–5. „ „ Sections of large brush showing glandular nature of brush bag (3–5) and appearance of hairs which arise therein.

(All × 50.)

Explanation of Plate XVIII.

Fig. 1. *Amauris egialea.* Section of wing patch parallel with direction of nervures. (× 175.)

2. ,, ,, Ditto transversely to same. (× 175.)

3. ,, ,, Comparative appearance of ordinary scales of wing and those in scent patch. (× 212.)

4. ,, ,, Semidiagrammatic surface view of part of wing patch showing "cupped" and blind glands and position of scales. (× 250.)

5. ,, ,, Transverse section of one of central bodies of brush. (× 400.)

6. ,, ,, Ditto of one of the "first ring" bodies. (× 400.)

7. ,, ,, Ditto of one of the "yellow hairs." (× 600.)

8. ,, *ochlea.* Transverse section of one of the "third ring" bodies showing nodules. (× 700.)

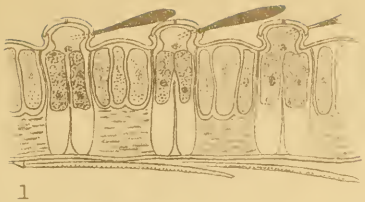
9. ,, ,, Longitudinal surface view of same. (× 600.)

10. ,, *hecate.* One of the scales of wing patch. (× 230.)

11. ,, ,, Transverse section of a dust hair. (× 700.)

12. ,, ,, Section of wing patch parallel with nervures. (× 160.)

13. ,, ,, Transverse section of a "yellow" and a black hair from brush. (× 700.)



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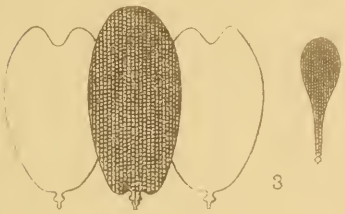

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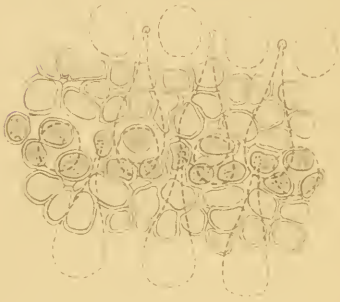

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H. Eltringham del. West, Newman lith.

DANAINE SCENT-ORGANS

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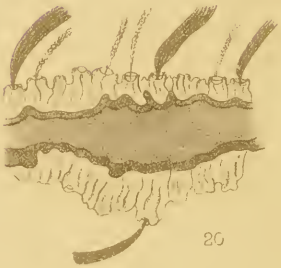

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DANAINE SCENT-ORGANS

Explanation of Plate XIX.

Fig. 14. *Amauris whytei.* Section of wing patch. (× 200.)

15. ,, ,, Transverse section of one of the "yellow" hairs. (× 350.)

16. ,, ,, Ditto of one of the granulated hairs breaking up to form dust. (× 350.)

17. *Parantica eryx.* Section of wing patch. (× 250.)

18. ,, ,, Longitudinal surface view of part of one of the brush hairs. (× 700.)

19. *Tirumala petiverana.* Section of part of wing pocket showing scent scales and double layer of cells. (× 150.)

20. ,, *limniace.* Section of alar scent organ, made from a dried pupa, showing remains of filaments which form the dust. (× 75.)

21. ,, *petiverana.* Longitudinal surface view of part of a brush hair. (× 450.)

22. ,, *limniace.* Fragments of the dust filaments. (× 750.)

23. ,, *petiverana.* Transverse section of a brush hair. (× 850.)

24. *Danaida chrysippus.* Two cells from lining of alar scent pocket. (× 120.)

25. ,, ,, Section of unexpanded wing showing folds of chitin, scale-forming cells, etc. (× 120.)

26. ,, ,, Section of brush hair. (× 850.)

27. ,, ,, Longitudinal surface view of part of same. (× 850.)

Explanation of Plate XX.

Fig. 28. *Danaida chrysippus.* Section of part o unexpanded wing taken through area which will form scent pocket in the imago. (× 500.)

29. ,, *lotis.* Section of part of alar scent pocket showing scent scales with large cells alternating with small cells and rudimentary scales. (× 150.)

30. *Trepsichrois mulciber.* Section of hair socket from brush bag showing gland cells associated with hair. (× 125.)

31. ,, ,, Epithelium, funnel socket, and part of membranous tube from accessory vesicle. (× 125.)

32. ,, ,, Transverse section of a brush hair. (× 750.)

33. ,, ,, Longitudinal surface view of part of same. (× 750.)

34*a*. ,, ,, Scale from fur patch of hind-wing. (× 75.)

34*b*. ,, ,, Scale from discoidal cell patch of ditto. (× 75.)

35. ,, *brookei.* Part of a brush hair showing projections. (× 500.)

36. *Hestia lynceus.* Gland cells of one of the hairs of large brush. (× 125.)

37. ,, ,, Surface view of part of a hair from large brush. (× 500.)

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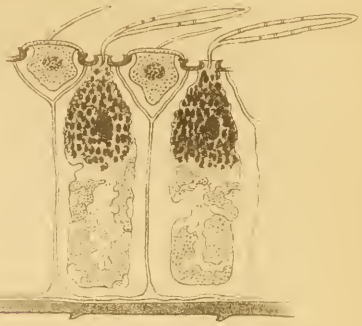

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DANAINE SCENT-ORGANS

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11, Chandos Street, Cavendish Square, W.

Session 1915–1916.

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Wednesday,	June	2
,,	October	6
,	,, ...	20
,,	November	3
	,, ...	17
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1916.

,,	January (Annual Meeting)	19
,,	February	2

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V. *New Butterflies and a Moth from Biak.* By J. J. Joicey, F.L.S., F.E.S., and A. Noakes, F.E.S.

[Read February 3rd, 1915.]

Plates XXI—XXVIII.

The Island of Biak is the largest of the Schouten or Misory Islands which lie outside Geelvink Bay, North New Guinea. It was first explored entomologically by Mr. W. Doherty, who visited it in 1892. He was only able to stay a short time, and in the bad season. His collection was therefore a small one, but it contained several new and distinct forms. The island was not again visited by collectors till Messrs. A. C. and F. Pratt went there during the year 1914. They were able to remain over two months and make extensive collections. The island seems peculiarly rich in specialised forms, and the species show as much affinity with those inhabiting the Moluccas and Bismarck Archipelago as with New Guinea forms.

The present paper contains thirty-one forms which we regard as new, and several of these are quite distinct; in addition, we record the other sex of four species which had not previously been known in both sexes.

We are indebted to the Lord Rothschild and Dr. K. Jordan for much kind help, and the opportunity afforded of examining specimens in the Tring Museum.

The specimens were all collected in May and June, 1914, and obtained in the southern part of the island called Bosnik.

We hope to be able to publish later a complete list of the butterflies known from this island.

Papilionidae.

1. Papilio othello obscurata, ♀ forma nov.

(Plate XXI, fig. 1.)

Near *melia*, Roths., from Mefor. Differs from this in the much reduced red spots on the hindwing above. On the underside the discal spots are washed out and the red submarginal spots reduced,

more lunate and typical of *aegeus* forms, whereas in *melia* they are bar-shaped. On the forewing there is only a faint light scaling beyond the cell towards the apex.

Five examples.

2. **Papilio euchenor comma,** subsp. nov.

♂. Forewing with the two upper apical spots larger and more rounded, the one near the margin smaller than in *euchenor*. On the hindwing near apex there is a well-defined curved bar which crosses cellule 7. This is represented below by an orange bar also present in the typical form, but it is larger than in that. The submarginal lunules are more lunate than ∧-shaped and are separated at the veins; the first in cellule 4 is orange like the others.

♀. Apical spots of forewing as in ♂. The patch at inner margin much smaller than in *euchenor*, the one above it reduced to a streak. On the hindwing the mark in cellule 7 is not so well defined. Hindwing below as in ♂ and all blue scaling reduced. The edge of the discal prong in cellule 6 is scaled with orange and to a less extent the lower of the two prongs in 5.

One ♂ differs from the others in having two spots outside cell at its end; these are indicated as dots in another specimen. Also, the band is deeply incised proximally on veins 2 and 3. The mark in apex of hindwing is absent, but the underside of hindwing is typical of the subspecies.

A small series of ♂♂ and 2 ♀♀ obtained.

3. **Papilio felixi,** sp. nov.

(Plate XXI, fig. 2.)

Nearest to *thule*, Wall., but quite distinct. ♂. *Upperside* of forewing black with greenish-white markings. A dot in cell near base, a curved streak beyond it, a larger similar streak in middle of cell, a curved streak beyond and opposite vein 4, its middle forming a triangular spot only slightly connected with a spot at each side. A short streak near lower angle of cell opposite vein 5, a round dot near upper angle of cell. Beyond cell an elongate spot at base of cellule 8 with a dot distally of it, a double spot below it in 6, 3 discal spots in 5–3 with a smaller spot opposite each near cell, similar spots in 2 joined to form a streak. A double streak in 1*b* and 1*c*, the upper the longer and joined to a round spot at the base. A submarginal row of spots as in *thule*. Hindwing with a longitudinal streak in cell obscured by dark

scaling except at end of cell where a spot is formed. Five discal streaks close to cell in 2–6, all widely separate, that in 6 the longer, those in 3 and 4 the shorter. A streak in 1c joined to the anal spot. A submarginal row of 7 spots as in *thule* but larger.

Underside similar to upper. On forewing the cell-folds divide the two upper streaks into three spots. The discal spots are faintly connected with spots near the cell. On hindwing a streak in cellule 7 defined at base and becoming obsolescent. Cell streak broader and better defined than above.

♀ with wings more rounded. Markings enlarged and paler, submarginal spots white.

Length of forewing: ♂ 44·5 mm., ♀ 45·5 mm.

A small series obtained.

Pieridae.

4. **Elodina biaka**, sp. nov.

Allied to *umbratica*, Gr.-Sm., from the Solomons.

♂. The black margin of the forewing is more irregular on its edge than in *umbratica*. Below, the apex is washed with yellowish-white and proximally of this the black above shows through as a narrow band.

♀. Similar to ♂. The hindwing below is yellowish.

Length of forewing: ♂ 22 mm., ♀ 25 mm.

A series of both sexes.

5. **Delias maudei**, sp. nov.

(Plate XXIII, figs. 3, ♂, 4, ♀.)

This fine species is intermediate between *enniana*, Obth., and *waterstradti*, Roths.

♂. *Upperside* white. Forewing with a narrow black apical and outer margin ending below the first submedian and having its inner edge deeply serrate, being invaded by triangular projections of ground-colour between the veins. An oblique patch of black scaling from vein 6–3 where it joins margin, cutting off 3 spots of ground-colour, the one in 5 being the larger. Lower disco-cellular scaled with black. Hindwing with a brownish-black marginal border from middle of cellule 4 to first submedian, narrowing at each end and being 4 mm. wide in cellule 2; its inner border is nebulous and greyish from band below showing through, and a spot of this colour invades the band in 3.

Underside of forewing with white ground-colour. Cell pale yellow at base. A curved black band on discocellular, lying mostly outside cell, narrowing along its upper part and continued within it as dark scaling to the base. This band does not join costa and space between it and costal vein is yellowish. A subapical black band, narrowing posteriorly, from costa to just below vein 2, its edges irregular. A black apex and narrow margin as above. Two yellow apical spots. Costa black, white towards base. Hindwing with basal two-thirds yellow. A brownish-black margin extending from costa above vein 7 to anal angle, its inner edge well-defined, curved to vein 4 where it is 2 mm. from cell, and thence is nearly straight to inner margin. A marginal row of 7 conspicuous yellow spots, the two at anal angle being much smaller than the others.

♀. *Upperside* smoky-brown, paler in the basal half. Forewing with apical and submarginal white spots decreasing in size posteriorly, those at the apex being elongate. Hindwing yellowish-white at costa, greyish below the cell. A marginal row of ill-defined yellowish spots.

Underside of forewing with basal part of cell yellow, a white inner-marginal area to beyond vein 3, and white submarginal spots as above but more distinct and larger, the two nearest apex being tinged with yellow. Costa, outer margin, and discal area with upper part of cell brownish-black. Hindwing with yellow basal half to near end of cell, distal half brownish-black. Marginal spots as in the ♂.

Length of forewing: ♂ 35·5 mm., ♀ 34 mm.

A small series obtained.

6. **Delias multicolor**, sp. nov.

(Plate XXIII, figs. 1, ♂, 2, ♀.)

Allied to *gabia*, Bdv. ♂. *Upperside* white. Forewing with black apical and marginal area ending in a point at vein 2 and bearing 3 white spots at the apex. These spots are joined to the margin by a streak-like prolongation of their outer edge. Costa black to the base. Hindwing with a narrow black margin, indented on intraneural folds, extending from vein 4 to first submedian. Red spots of underside show through.

Underside. Forewing similar to upperside, apical spots yellow, first spot much larger than above. Extreme base yellow. Hindwing with basal half yellow to end of cell. Anal area to vein 4 bright orange, fainter in 3. The costal area, part of cellule 6,

and outside end of cell is washed with orange. A black marginal band as above but twice as wide and bearing 3 large somewhat heart-shaped spots of bright orange, their apices resting on the margin. Three small marginal spots of same colour in 4–6.

♀. *Upperside* white. Forewing blackish at base. Costa, apex, and outer margin black with a well-defined inner edge. A marginal row of white spots decreasing in size from cellule 6–2, those in 4–2 being close to margin; a dot before the first spot near costa. Hindwing with basal part including cell, pale yellow. A black marginal border 3 mm. wide, from apex to first submedian, its inner edge crenulate. Three yellowish marginal dots in cellules 2–4.

Underside similar to ♂. Forewing with increased apical and costal black, and yellow apical spots smaller than in ♂. Basal yellow fills half the cell. Hindwing with distal area from centre of cellule 7 to inner margin, bright orange, basal half yellow. Marginal band 4 mm. wide bearing spots of bright orange as in ♂, the spots in 4–6 well developed, the last being outside the band.

Length of forewing: ♂ 29·5 mm., ♀ 26·5 mm.

A series.

7. **Delias bosnikiana**, sp. nov.

(Plate XXIV, fig. 1.)

This species bears a superficial resemblance to the preceding one, but we think it belongs to the *poecilia* group.

♂. The forewing is more produced at the apex than in *multicolor*. It differs above in the much narrower black margin which only reaches just below vein 4, and in the consequent absence of apical spots. The hindwing bears some black scaling around the ends of veins 2, 3, and 4. The underside differs from *multicolor* in the increased costal and apical black, and the larger apical spots all of which are white. The inner-marginal orange area is more strongly defined and extended basally. The marginal black is broader and the spots smaller, those in 5 and 6 being absent.

♀. *Upperside* black, basal half sparsely powdered with white. Forewing with three large white apical spots prolonged basad, a faint white subcostal streak, a rounded spot in 3, a small spot in 2, and a dot in 1c. Hindwing with costa white. A submarginal row of pinkish-white spots in 2–6, somewhat heart-shaped, their apices directed to the margin.

Underside of forewing with basal half white, tinged with lemon-yellow in cell and outside its lower edge. Costa black to base.

Apical and submarginal spots large and better defined. Hindwing with outer half black, including apex of cell; basal half greenish-yellow, its outer edge tinged with orange at abdominal margin and a patch of orange on costa. Submarginal spots as above, bright orange, larger and more rounded than on upperside, a double spot in 1*c*.

Length of forewing: ♂ 30 mm., ♀ 26·5 mm.

A small series of both sexes. A figure of the ♀ will be given in a succeeding paper.

We may here note that five of the seven Delias now known from Biak have ♀♀ with dark upperside and prominent submarginal spots.

8. **Delias dohertyi knowlei,** subsp. nov.

(Plate XXII, figs. 5, ♂, 6, ♀.)

♂. *Upperside* white with very narrow black costal and outer margin to forewing. *Underside* of forewing white. Apex lightly scaled with black, filling interspace 8 and extending outwardly to below vein 6; costa black, whitish towards base. A dark yellow spot at apex, traversed by the black veins and reaching below 6. Hindwing black. A red costal streak edged with black at margin. The margin from apex to base is sprinkled with grey-white scales forming a band 3–4 mm. broad.

♀. *Upperside* grey-black. Forewing with basal half scaled with grey-white. Hindwing with basal part including cell and inner marginal area, and extending to vein 6 between cell and margin, grey-white. *Underside* similar to ♂. Forewing with increased apical black, hindwing with a somewhat wider grey-white margin.

Length of forewing: ♂ ♀ 32 mm.

A series. *D. dohertyi*, Ob., is wrongly placed by Fruhstorfer in Seitz's "Macrol." in the genus *Huphina*.

9. **Delias talboti,** sp. nov.

(Plate XXII, figs. 1, ♂, 2, ♀.)

♂. *Upperside* white. Forewing with narrow black apex and outer margin ending in a point at vein 2. *Underside* black. Forewing with basal half to near end of cell, base of 3, part of 2, most of lower median area, and inner margin white. Basal two-thirds of cell tinged with yellow. Four apical white spots and a faint spot in 3 near margin. Hindwing with costa yellow at base. A

marginal row of square-shaped grey-white spots in cellules 1*c*–6. Inner margin faintly scaled with grey-white anteriorly and with dark yellow at the base.

♀. Wings rounded. *Upperside* black; basal area greyish-white with some yellow scaling, rendered dark by the underlying ground-colour. Forewing with a submarginal row of 6 white spots which are larger towards apex. Hindwing with a similar row of smaller spots of nearly equal size. Inner margin grey-white.

Underside black. Basal three-quarters of cell to below median yellow. Submarginal spots as above but larger and better defined. A distinct spot touching margin, on first submedian fold. Hindwing with costa yellow at base and yellow scaling extending to inner margin. A submarginal row of 7 well-defined white spots much larger than those above; those in 6 and 7 tinged with yellow.

Length of forewing: ♂ 35·5 mm., ♀ 32·5 mm.

A series.

10. **Delias biaka**, sp. nov.

(Plate XXII, figs. 3, ♂, 4, ♀.)

Allied to *dorimene*, Cram. ♂. *Upperside.* Forewing paler than in the allied species, costa and apex black, outer margin narrowly so to below vein 2. Apical black proximally bordered by 4 well-defined white apical spots, and a dot in 2 and 3 close to margin. Upper edge of cell streaked with grey-white. Hindwing creamy-white with a black outer marginal band which is paler distally and broader than in *dorimene*; the veins crossing it are black from their ends to a little proximal of the band. Four marginal white dots, the two first in 5 and 4 the largest. A greyish suffusion at the base.

Underside of forewing with basal half suffused with grey. Apical spots larger and better defined than above. Hindwing with yellow ground-colour paler than in *dorimene*. Areas 1*c*, 2, and 3 shaded with orange. Black marginal band as above and veins only black within it. A marginal row of 4 elongate white spots separated by the veins. The ground-colour invades the band in cellule 5.

♀. *Upperside* black, greyish at the base. Forewing with 4 white apical spots and a dot before the first. Hindwing with 4 rounded white submarginal spots in 2–5, and an indistinct one in 6.

Underside ground-colour black. Forewing with a submarginal row of 7 white spots from costa to outer angle, the second and third the largest, the last an indistinct dot. Basal half greyish-white. Hindwing with costa, base, and inner margin yellow. A sub-

marginal row of 7 large rounded spots, the first two the larger, pale orange, in 6 and 5, others white.

Length of forewing : ♂ ♀ 31 mm.

A series.

Since the descriptions of the sexes of this species were written, we have received a pair taken *in cop.*

11. **Appias albina pulverobasalis,** subsp. nov.

(Plate XXIII, figs. 5, ♂, 6, ♀.)

♂. The base of forewing and less so the base of hindwing is suffused with dark scaling above. Costa of forewing much more thickly scaled.

♀. There are five forms in the series sent. Of the typical white forms there is *principalis*, Fruh., and *semiflava*, Fruh. The yellow forms comprise *flava*, Röb., and two which seem to be intermediate. One of these is similar to *flava* but larger and base of forewing more scaled with yellow. The other is similar but darker at base of forewing, no apical spots, and a wider marginal band on hindwing.

We figure this form. The latter and the form *semiflava* were taken *in cop.* with the ♂ form above described. A long series of both sexes, but only a few of the yellow ♀ forms.

12. **Appias ega falcidia,** Fruh. ♂.

(Plate XXV, figs. 1, ♂, 2, ♀.)

Seitz, "Macrol." ix, p. 156. ♀. Smith, Nov. Zool. 1, p. 337, as *saina* ♀.

Similar to *saina*, Sm., which has not yet been properly described, as Smith's "♂" is a ♀. Apex and costa narrowly margined with black, veins at apex black at ends and a certain amount of black suffusion between them. Some dark scaling along costal margin increasing at base. The black spots which occur in 3 and 4 as in *ega* are sometimes quite absent or the one in 2 is much enlarged; there is a tendency for the spot in 4 to become obsolete. Underside with apex, base of forewing and whole of hindwing sulphur yellow.

A ♀ specimen differs from the others in the absence of apical spots on forewing above, a narrower margin on hindwing, and below with apex and distal margin of hindwing brown without any yellow suffusion.

A series of both sexes.

In Seitz, "Macrol." ix, pp. 155–156, Herr Fruhstorfer has not correctly identified *Appias melania*, F., and sinks *ega*, Bdv. as a synonym. The type of *melania*, Fabr., is in the Banksian cabinet in the British Museum. It is a ♀ specimen and represents the altogether different *asteria*, Misk., so that this name must sink. The group of races which Fruhstorfer, loc. cit., treats as one species, consist probably of two; these would be represented by *paulina*, Cram., and *ega*, Bdv., respectively.

We have received a pair of this species taken *in cop.* The ♀ is much smaller than ♂ in this case.

13. **Appias ada solis**, subsp. nov.

(Plate XXIV, figs. 2, ♂, 3, ♀.)

Near *thasis*, Fruh., but has reduced apical and marginal black above.

♂. *Upperside* of forewing with costa and outer margin to vein 3 narrowly black, the margin being proximally dentate; some dark scaling at costa near apex. Hindwing with margin black from vein 6 to first submedian, invaded by ground-colour between veins, very narrow to vein 4, widening to nearly 3 mm. on vein 3 and ending in a point.

Underside of forewing with upper edge of cell and costa except at base, black to near apex, limited by vein 6. Apex narrowly black and some black scaling along margin to vein 4, intervening space in 6 tinged with yellow. Hindwing bright yellow over cell and costal area. A brownish-black marginal band 7 mm. broad from 6 to anal angle, edged with orange proximally. The inner marginal area, cellules 2 and 3 proximally of the band, and an apical spot in 6, is orange.

♀. *Upperside* of forewing with base scaled with black, including two-thirds of cell. Costa and apex black, extending along margin and narrowing to vein 2, being deeply serrate between 6 and 3. Hindwing tinged with yellow. A black marginal border 4 mm. wide.

Underside of forewing as in ♂ but base lightly scaled with black and apical spot orange yellow. Hindwing with basal half yellow to end of cell, distal half blackish-brown. An orange spot at apex in 6 and an orange patch at inner angle.

A series of both sexes.

14. **Pareronia chinki**, sp. nov.

(Plate XXIV, figs. 4, ♂, 5, ♀.)

A very distinct species which we have pleasure in naming after the collector, who will forgive us for taking his nickname.

Nearest *jacobea*, Bdv. ♂. *Upperside* of forewing greenish-white, leaving a narrow black margin extending from base, round apex where it is 5 mm. broad, to just below vein 2 where it narrows to a point. Some greyish scaling at base of costa. Hindwing greenish-white with androconial patch extending from above vein 7 to below 6 and reaching apex. A black marginal border 3 mm. broad from apex to inner angle; white streaks at its proximal edge on intraneural folds in 1*c*, 2–4.

Underside with narrower black costal margin and two thin short streaks in apex, a streak in 6 and marginal black dentate on the veins. Hindwing brownish-black with a submarginal row of rounded white spots each traversed by a short vivid white line on the intraneural fold. In 1*c* two streaks broadened distally, a similar streak in 6, and another in 7 without scaling at sides of fold. Some light sparse scaling proximally of the spots from inner margin to cellule 6.

♀. *Upperside* ground-colour brownish-black with white markings. A streak through centre of cell narrowing towards base, a much thinner streak almost fused with it anteriorly, and a streak below it showing mostly as an elongate spot at end of cell. Beyond the cell a subcostal streak, a larger one below it in angle of 6, a longer one in 5, one in 4, an oblong spot in 3, an elongate spot in 2; two streaks in lower median area extending from terminal spot to base and scarcely separated by a thin line of ground-colour; below submedian a marginal streak not reaching outer angle. At apex 3 short streaks followed by a row of submarginal spots, those in 4 and 5 smaller than the others and the one in 3 the larger. Hindwing with cell white except its lower edge, and traversed by a faint streak of dark scaling. A subcostal streak and 4 elongate discal spots round cell, a thick streak in 2, two streaks in 1*c* divided by submedian fold, their pointed outer ends joined each to a submarginal white spot. Inner margin white along both sides of lower submedian. A submarginal row of 6 rounded white spots.

Underside with all white markings much increased. Cell-streaks

and inner marginal streaks confluent, and discal patches only separated from cell by the veins.

Length of forewing : ♂ 40 mm., ♀ 42 mm.

A series.

Euploeinae.

15. **Euploea tripunctata**, sp. nov.

(Plate XXVI, fig. 1, ♂; Plate XXV, fig. 3, ♀.)

♂. *Upperside* deep purplish-brown shot with blue in a side-light. A thin stripe of androconia in the lower median area of forewing. Hindwing with 3 bluish-white apical spots, the one in cellule 4 a mere dot.

Underside paler than above. Forewing with a blue gloss round the cell and partly invading it. Some bluish-white spots,—one at end of cell, a curved series of 5 beyond cell in 2–6, the one in 5 being a dot, a dot near costa in 10, a dot in 6 near margin. Inner margin grey. Two thin greyish though somewhat obscured stripes which converge basally in lower median area. Hindwing with a spot at end of cell, 6 round the cell in 1*c*–6, the first being a short streak, 3 apical white spots, a few marginal dots.

♀. *Upperside* coffee-brown, paler at the margins. Forewing shot with blue over the disc and hindwing faintly so. Hindwing with 3 white apical spots.

Underside paler than in ♂ and with similar markings. The marginal dots on hindwing extend from 1*b*–6, in pairs in each cellule except in 1*b*.

Length of forewing : ♂ 39 mm., ♀ 42 mm.

A series.

This species is nearest *lacon*, Sm., but has a longer sexual stripe and is much darker. It shows no variation above, but *lacon* varies in amount of blue gloss, in the spots being present or absent, and the sexual stripe may be quite wanting.

16. **Euploea incerta**, sp. nov.

(Plate XXV, fig. 4.)

Allied to *obscura*, Pag. ♂. *Upperside* dark coffee-brown, forewing a little paler at apex and outer margin, hindwing with only the disc darker than the rest. The pale costal area of hindwing reaches vein 6.

Underside paler than upperside. Forewing with two broad

greyish stripes in lower median area, dilated basally as almost to touch. A spot at end of cell, 3 beyond it in 2–4, the one in 4 being a streak, a small spot in 3 near margin. Hindwing with a spot at end of cell, 5 spots round cell in 2–6, 3 apical spots in 4–6, an outer marginal row of dots in pairs in each cellule.

Length of forewing: 43 mm.

Nine examples.

17. **Euploea albicosta**, sp. nov.

(Plate XXVI, fig. 2.)

♂. Forewing narrow, inner margin rounded. Hindwing short and narrow. *Upperside* of forewing deep brown, paler at the apex and outer margin. Hindwing deep brown in lower part of cell, paler round the cell and merging into a pale distal area. An oval costal patch of cream-coloured scales from vein 8 to the cell, invading its upper part and filling base of cellule 6; distally of this patch some white scaling, costal edge grey.

Underside paler. Disc of forewing and disc and costal area of hindwing darker than the rest. On forewing a spot in cell near origin of vein 3, three spots outside cell in 2–4, a small spot in 6 near margin. Inner margin white nearly to base, and some white terminal scaling above submedian. Hindwing with a spot at end of cell, a series of 6 spots round cell in 2–7, a smaller spot in 7 near margin, 3 apical spots in 4–6, a pair of marginal dots in 5 and a pair in 6.

Length of forewing: 42 mm.

Two specimens only.

This has apparently no near ally, but belongs to the first section of *Euploea*.

Nymphalidae.

18. **Cynthia arsinoe bosnikensis**, subsp. nov.

Nearest to *rebeli*, Fruh., but smaller, paler, and forewing less produced at apex.

♂. *Upperside* of forewing with reduced markings which are less defined than in *rebeli*. Discal spots smaller, the one in 4 obsolete. There is no subcostal spot in 6. Hindwing with discal line absent, the two eye-spots and submarginal spots smaller, submarginal line thinner, and marginal border very thin. *Underside* much paler than in *rebeli*, markings similar. On forewing the discal dot in 2 and the one below 2 obsolete.

♀. *Upperside* with well-defined white band and darker ground-colour than in *rebeli*. Discal spots smaller and first submarginal line is less undulate. Hindwing with white costal patch suffused by dark scaling between the two discal lines which are distinct.

Underside paler than in *rebeli* ♀ and without any reddish tint. Forewing with the discal dot in 5 and the one below vein 2 obsolete. Hindwing with the pale discal band much lighter, eye-spots smaller, and submarginal lines closer together.

One ♀ shows the white band darkened distally.

Length of forewing: ♂ 47 mm., ♀ 43 mm.

A series.

19. Cirrochroa imperatrix, Sm. ♀.

Nov. Zool. 1, p. 348, ♂.

Similar to the ♂, basal blue not so bright. Underside paler at base, discal blue line a little wider as is also the proximal blue bordering of the submarginal brown band.

Length of forewing: 40 mm.

A small series from Biak, June 1914.

20. Cethosia chrysippe schoutensis, subsp. nov.

(Plate XXVII, figs. 1, ♂, 2, ♀.)

Nearest to *lucina*, Fruh., from Jobi. Outer margin of wings less strongly undulate than in other *chrysippe* forms.

♂. *Upperside* shot with deep blue except at margins. The white subapical patch extends from subcostal 4 to vein 2, is rounded on its outer edge, and is 9 mm. broad between veins 4 and 6. A short subcostal streak before the band. The red at base of cellule 2 is more reduced than in allied forms. Submarginal white dots are only faintly indicated and this in a very few specimens. There is a tendency to develop a dot in 2 on forewing and to reduction in size of spot in 2.

Underside darker than in *damasippe*, Feld. The submarginal spots on hindwing larger and somewhat produced proximally. A reddish suffusion between the discal bands and distally of the outer band, the red spot at end of cell brighter.

♀ differs as in the allied forms.

A series.

21. **Symbrenthia hippoclus nigroapicalis**, subsp. nov.

(Plate XXVI, fig. 3, ♂, 4, ♀.)

♂. Forewing with the spot in 4 enlarged and narrowly joined to the spot at base of 3. No spot in apex. The submarginal spot in 4 represented by a dot. The inner marginal band is reduced to a triangular spot reaching vein 2 which separates its apex from a spot in cellule 2 placed distally of it.

♀. On the forewing resembling the ♀ of *hylaeus*, Wall. There is a short black streak in the band between veins 3 and 5 in the type specimen.

4 ♂♂, 2 ♀♀ obtained.

22. **Mynes geoffroyi aureodiscus**, subsp. nov.

(Plate XXVII, fig. 3, ♂.)

Allied to *semperi*, Stgr. ♂ differs above in having an ill-defined apical streak, some dark scaling at base of wing, and some greyish scaling at terminal margin of white area. On hindwing the black margin is broader and occupies half the costa. The light central patch is square-shaped and much reduced distally and costally, being limited by vein 7 and separated from a light stripe at inner margin of the greyish discal colour.

Underside of forewing similar to *semperi*; costal spot directed basally, yellow apical spots larger, and extended black in cellule 4. Hindwing with reduced discal patch as above, limited anteriorly by vein 7 and posteriorly by first submedian, being separated by some yellow scaling from inner marginal yellow border. The distal edge of the patch is nebulous and there is some yellow scaling in the space between it and an outer yellowish discal line which represents the limit of the discal patch in *semperi*.

♀. *Upperside* black with basal half suffused with yellow scaling. Forewing with a yellow patch at base of cell, and a creamy apical band. Hindwing with basal half of cell yellow, base of costa and inner margin whitish. A narrow creamy marginal band.

Underside of forewing yellowish in and around cell. Black area enlarged posteriorly, reaching below 3 and thence narrowing to outer angle. Costal spot divided and apical spots forming a band. Hindwing with yellow discal area much enlarged, reaching subcostal, extended to the base, and merged in the inner marginal area which is extended posteriorly. Red costal streak more extended.

A series of both sexes.

In the ♂ the yellow discal patch on hindwing below varies from a breadth of 4·5 mm. to 9·5 mm. Two ♀♀ have a creamy scaling over disc of forewing.

A small series of the dark form *doryca*, Butl., was received. There are no intermediates.

23. **Hypolimnas pithoeka fumosus**, subsp. nov.

♂. *Upperside* of forewing a deep smoky-brown which is darker than in *pithoeka*; paler at apex and along outer margin where the marginal line is distinct. Hindwing with dark basal area same colour as forewing, distal area much paler.

Underside markings as in *pithoeka*. Ground-colour pale olivaceous-brown except the darker posterior area of the forewing. Marginal line much thinner and closer to margin.

♀. *Upperside* paler than ♂, discal area and band of forewing coloured as in *pithoeka* and with some reddish-brown scaling. Hindwing light olivaceous-brown, a white discal dot in 6.

Underside as in ♂ but a little paler. White fringe dots between veins on hindwing.

A series.

24. **Doleschallia bisaltide nigromarginata**, subsp. nov.

This form is allied to *nasica*, Fruh., from Waigeu.

♂. The wings are widely margined with black. The discal area of forewing extends to vein 4, filling base of cellule 3. The costal patch varies in size and in one specimen is reduced to two small spots; the space between it and the cell is in another specimen almost filled in with brown. Another specimen is much nearer *nasica* in the narrower black margins, and hindwing with only costa and apex black. The outer margin of forewing is more concave, and of hindwing more straight than in other specimens.

♀. Similar to ♂. Discal area of forewing more extended, costal patch larger.

6 ♂♂, 1 ♀ obtained.

25. **Doleschallia noorna fulva**, subsp. nov.

♂. *Upperside* of forewing with apical and outer margin narrower than in typical form. The lower three apical spots are obsolete, and the discocellular spot enlarged. On the hindwing the dark apical margin only reaches vein 4; discal spots obsolete; submarginal and marginal lines much less heavily marked.

Underside with more uniform ground-colour and reduced white markings.

♀. *Upperside* paler than in *noorna*; outer marginal border of forewing narrower, being about 3 mm. broad. Discocellular spot evanescent posteriorly. Hindwing without any dark suffusion along outer margin except a faint scaling at apex.

Underside marked as in *noorna* but paler.

A series obtained.

Specimens in collection of Joicey from Mefor agree with the above form.

26. **Acca venilia albopunctata,** subsp. nov.

Nearest *pseudovenilia*, Fruh., from Dutch N. Guinea.

♂. *Upperside* of forewing with blue median area reduced, the two upper spots being narrowly margined. The edges of median spots are straight instead of rounded. Submarginal dots smaller than in venilia. Band on hindwing narrowly margined with blue. *Underside* of hindwing with band not edged with grey distally, and marginal spots absent.

♀. *Upperside* with dead white markings without any trace of blue, the place of this colour being taken by a slight grey scaling. On forewing the median spots are larger, and on hindwing the band is broader with a straighter distal edge.

Underside with white markings and similar to ♂.

3 ♂♂, 6 ♀♀ obtained.

27. **Neptis shepherdi gregalis,** subsp. nov.

(Plate XXVI, fig. 5, ♂.)

Allied to the form *damia*, Fruh., from N. Guinea, late German Territory.

♂. *Upperside* with all spots on the forewing larger than in *damia*. On the hindwing the discal band narrows posteriorly and all the spots are separated by the black veins. A postdiscal row of 6 white spots and parallel to them a submarginal row of faint white dots.

Underside with darker ground-colour than in *damia*, spots as above. Hindwing with a pale subcostal streak; a small spot in 6 forming anterior end of discal band; a pale but distinct discal line; postdiscal spots larger than above; a well-marked submarginal line and a thin marginal one.

♀ similar to the ♂. A narrow discal band on hindwing composed of more widely-separated spots above.

A series. June 1914.

28. **Euthalia aeropus angustifascia**, subsp. nov.

(Plate XXVII, figs. 4, ♂; Plate XXVIII, fig. 1, ♀.)

Near *eutychius*, Fruh., from N. Guinea. ♂. *Upperside* with bands narrower than in *eutychius*. On the forewing the lower median and inner marginal spots are broadened. Outside cell at its upper end a single dot instead of two as in N. G. form. On hindwing the band does not narrow posteriorly but is of a uniform breadth of 3·5 mm., and is straight on both edges. A curved mark joining the band posteriorly on outer edge, encloses a semicircular spot. *Underside* as in *eutychius*. Forewing with increased black area reaching vein 3. The cell-spot not so well defined, and median spots smaller.

♀. Bands much narrower than in other forms. *Upperside* with pale yellowish-brown bands. No spot in cell but a faint dot at upper end in angle of 5. Spots of the band more widely separate than in allied forms, and the three subapical ones are tinged with white, the two apical also white. Band on hindwing of a uniform breadth, about 5 mm. broad.

Underside of forewing with the band white. A trace of a discal spot in 2, a small one in 3. Eye-spot in cell less well-defined than in *eutychius* form. Hindwing not paler basally, band as above.

A series obtained.

29. **Prothoe australis satgeii**, subsp. nov.

(Plate XXVIII, fig. 2, ♂.)

♂. *Upperside* of forewing as in *australis*, Guér. Hindwing with discal patch rounded and only reaching anteriorly to middle of cellule 6. This patch consists of a creamy-white part placed distally, rounded outwardly, and proximally indented on veins 4 and 5. This is surrounded by greenish-grey which broadens proximally and adjoins a darker bluish area which forms the inner edge of the discal patch and is merged in the basal scaling.

Underside darker than in *australis*. Forewing with a submarginal row of 7 white dots, a white dot outside end of cell in interspace 4, and a similar curved dot within the cell at its end. Hindwing with reduced white discal patch consisting of 3 spots: the first nearly square in cellule 5, the second adjoining it in 4 is

larger and oblong, with straight edges, and fills breadth of cellule, the third in 3 is smaller than the first and rounded. A white dot in cell near base, a curved white mark near end of cell, a narrow white spot outside end of cell in 4, and a white dot above it in 5. Inner marginal streaks as in *australis* but much fainter, darker, and interrupted. The yellow tail spot is round, and there is a smaller marginal lunate spot in 2 which is greenish and tinged with yellow proximally. The margin outwardly of the discal patch and extending inwardly to the base of inner margin is much darker than rest of wing.

♀ similar to ♂ but larger. *Underside* of forewing with the submarginal spots fainter and the two lower ones absent. The third and smaller spot of the white hindwing patch is still further reduced.

Length of forewing : ♂ 40 mm., ♀ 48 mm.

A series.

30. **Charaxes latona marcia**, subsp. nov.

(Plate XXVIII, fig. 3, ♀.)

This rather distinct form is nearest *diana*, Roths., from N. Hanover.

♂. Resembles *diana*, Roths. *Upperside* : forewing with the black area extending to apex of cell and to a third of inner margin. The basal brown extends as a small spot beyond cell at lower angle, and along two-thirds of costa. Hindwing with the marginal black extending to near the middle and narrowing posteriorly from costa to middle of cellule 3, its inner edge being very slightly convex. Veins 6 and 7 are black nearly to their bases. Two submarginal brown spots in 6 and 7, followed by obscure dark-brown lunules in 5, 4, and 3, the last cutting off a round black spot, a similar spot in 2. Margin brown to vein 5.

Underside of a bronzy-green tint, markings as in ♀. The outer lunulate line on forewing bordered distally by blurred dark rufous spots, forming a band which becomes obsolete anteriorly. The median black bars edged with pinkish-white distally and broadly so in the lower median space, the white area merging into the similarly coloured inner margin. The basal median area has a pinkish tint. Hindwing : the discal black bars extend to cellule 2. The outer lunulate band is filled in with rufous-brown.

Length of forewing : 41 mm.

♀. Smaller than *diana* ♀ and the white band not divided as in that species. The outer row of lunate spots which form the distal half of the band in *diana*, are here reduced to vestiges ; the white costal spot

of the band is broader. The base of both wings is paler than in *diana*. On hindwing the white costal spot is narrower and prolonged to form a discal band which is obsolete below vein 3, the space between this band and the submarginal spots being as dark as base of wing.

On *underside* the light band is wider on forewing and straighter on hindwing than in the allied form. On forewing the post-discal lunulate line is bordered distally by a row of dark blurred spots which in *diana* are placed nearer the margin and are paler. On hindwing the white band fills the space between the two discal lines, and the yellowish margin of outer line is much narrower than in *diana*.

Length of forewing: 46 mm.

1 ♂, 3 ♀♀ obtained.

Amathusiidae.

Taenaris scylla, Stgr. ♀.

Tenaris scylla, Stgr. (u. Schatz), Exot. Schmett., vol. i, p. 193, 200 (1887).
Tenaris dohertyi, Sm., Novit. Zool., vol. i, p. 358 (1894).

♀. Larger and more rounded wings. Forewing with apex broadly smoky-brown and costa narrowly so; rest of wing pure white. The dark basal area below shows through above on both wings. Hindwing as in ♂ but with a broader marginal border from base of costa to anal angle.

Underside similar to ♂. The white patch on forewing broader and reaching vein 10. On the hindwing the white band is broader between the eye-spots.

A series of both sexes was obtained.

Satyridae.

31. Elymnias cybele umbratilis, subsp. nov.

♂. Allied to the form *holofernes*, Butl., but larger and darker, being sooty-brown above. *Underside* of forewing with 4 submarginal spots in 2–5, the one in 4 placed a little proximal of the spot above and below, the spot in 2 smaller and nearer the margin. Hindwing with the submarginal spots placed more proximal than in *holofernes*, and larger and more bluish.

Length of forewing: 42 mm.

5 ♂♂ obtained.

32. **Elymnias viridescens cinereomargo,** subsp. nov.

(Plate XXV, fig. 5, ♂.)

♂. Outer margin of both wings straighter than in the type form. *Upperside* of forewing with margins more bluish and darker than in *viridescens*, Sm. Hindwing with a much narrower band. Underside of a uniform dark olivaceous-brown. Forewing with no light apical suffusion. Hindwing with no light distal border but a margin of short white and intermixed striae.

♀. Larger than the ♂ and coffee-brown in colour. *Upperside* of forewing with the costa and a submarginal area paler than the ground-colour. Hindwing with basal area including cell of same ground-colour as forewing, distal area much paler.

Underside pale coffee-brown with broader marginal striation. Forewing with a small blue spot near the margin in cellule 4 and one above it in 5.

Length of forewing: 33 mm.

6 ♂♂, 1 ♀ obtained.

The ♀ is apparently mimetic. It bears on both sides a resemblance to the *Hypolimnas pithoeka*, and to the ♀ of *Euploea cerberus*, Butl., on the upperside.

A single specimen received which we hope to figure in a succeeding paper.

33. **Melanitis amabilis angulata,** subsp. nov.

♀. The white band does not reach below the submedian, is sharply angled just before, and ends in a point along the vein. Below, the angle is less pronounced.

Three specimens.

ERYCINIDAE.

34. **Dicallaneura princessa,** Sm., ♂.

(Plate XXVI, fig. 6.)

Nov. Zool., vol. i, p. 544, ♀.

Upperside similar to ♂ of *pulchra*, Guér., the band being a little shorter and wider than in that species. The ground-colour is darker and more strongly shot with blue. *Underside* as in the ♀. A smaller dark discal patch on the forewing, the 3 spots within it being slightly larger.

Length of forewing: 21 mm.

A series of both sexes was obtained.

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NEW BUTTERFLIES AND A MOTH FROM BIAK.

Explanation of Plate XXI.

Fig. 1. *Papilio othello* ♀ f. *obscurata*.
2. ,, *felixi*, ♂.
3. *Asota intermedia*, ♂.

Explanation of Plate XXII.

Fig. 1. *Delias talboti*, ♂.
2. „ „ ♀.
3. „ *biaka*, ♂.
4. „ „ ♀.
5. „ *knowlei*, ♂.
6. „ „ ♀.

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Explanation of Plate XXIII.

Fig. 1. *Delias multicolor*, ♂.
2. „ „ ♀.
3. „ *maudei*, ♂.
4. „ „ ♀.
5. *Appias pulverobasalis*, ♂.
6. „ „ ♀ form.

Explanation of Plate XXIV.

Fig. 1. *Delias bosnikiana*, ♂.
2. *Appias solis*, ♂.
3. „ „ ♀.
4. *Pareronia chinki*, ♂.
5. „ „ ♀.

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NEW BUTTERFLIES FROM BIAK.

Explanation of Plate XXV.

Fig. 1. *Appias falcidia*, Fruh., ♂.
2. „ „ „ ♀.
3. *Euploea tripunctata*, ♀.
4. „ *incerta*, ♂.
5. „ *cinereomargo*, ♂.

Explanation of Plate XXVI.

Fig. 1. *Euploea tripunctata*, ♂.
2. ,, *albicosta*, ♂.
3. *Symbrenthia nigroapicalis*, ♂.
4. ,, ,, ♀.
5. *Neptis gregalis*, ♂.
6. *Dicallaneura princessa*, Gr.-Sm., ♂.

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Explanation of Plate XXVII.

Fig. 1. *Cethosia schoutensis*, ♂.
2. „ „ ♀.
3. *Mynes aureodiscus*, ♂.
4. *Euthalia angustifascia*, ♂.

Explanation of Plate XXVIII.

Fig. 1. *Euthalia angustifascia*, ♀.
2. *Prothoe satgeii*, ♂.
3. *Charaxes marcia*, ♀.

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NEW BUTTERFLIES FROM BIAK.

Hypsidae.

35. **Asota intermedia**, sp. nov.

(Plate XXI, fig. 3.)

Resembles *orbona*, Voll., in general appearance but is linked with *australis*, Bdv., in the presence of the arrow-head mark at base of forewing. Ground-colour deep brown striped with ochre-yellow between the veins; the discal stripes are joined to the round yellow discal spot, the two lower median stripes to the basal patch. The inner marginal streak is not interrupted. Hindwing ochre-yellow, 2 dark spots at apex and 4 smaller ones on the margin.

Underside of forewing with apex broadly smoky-brown extending along costa nearly to base, forming a patch in the cell, and a broad distal margin; rest of wing and hindwing ochre-yellow. Outer margin of hindwing to vein 2 smoky-brown; a darker costal spot.

Palpi differ from all other forms of *Asota* in that the second joint is traversed by a black lateral line.

Length of forewing: 29 mm.

A single ♂ example.

Explanation of Plates XXI–XXVIII.

[*See Explanations facing the* Plates.]

VI. *The larva and pupa of* Caligo memnon, *Feld.* By F. L. Davis, M.R.C.S., L.R.C.P.

[Read May 5th, 1915.]

Plate XXIX.

So little has been published about the earlier stages of this insect that the following notes of observations made at Belize, British Honduras, may be worth placing on record.

The larvae, almost full grown and three in number, were found on the 22nd and 24th of December 1914, on the brick wall of a church in close proximity to a banana plant, a few of the leaves of which touched the wall. This faced north and was well shaded by tall shrubs. It appears to me that the larvae crawled from the banana leaves, escaping daylight as much as possible by placing themselves in dark corners of this wall. I surmise that they returned to their food-plant about sundown each evening, though how they could find their way to it is a mystery to me. During the day I found these larvae very lethargic, remaining in the same postion for hours together, and refusing food; but at night they became very active and ate voraciously the banana leaves supplied to them. They were nearly full fed, for on the 24th December one of them got in position for pupation by suspending itself head downwards, the body hanging free. and only the anal extremity attached to a small web on the lid of the box. The pupa appeared on the 26th December, but unfortunately, I suppose during the active movements necessary to cast off the larval skin, the pupa had become detached and fell a few inches to the bottom of the box. Here it lay on one side, and this side was imperfectly developed, being flattened out while the opposite side was normally developed. The larva was photographed on the 22nd December, and the photograph accompanies this communication. The second larva began to show signs of a change on the 27th December. Like the first one. it also constructed a small web on the lid of the box but did not succeed any better in attaching itself, for on the 29th December I found the larva itself at the bottom of the box in a very

advanced stage towards pupation. The fall was not more than four inches. I placed a piece of soft lint under it, thinking in this way to lessen the pressure, but on the 30th I found the pupa flattened out on the side it lay on in the same way as the first. This one died. The third larva died when it appeared to be getting ready to pupate.

The length of the fully-grown larva is 4½ inches and the diameter through the thickest part of the body about ½ inch. The body gradually tapers towards the head and tail, the central portion being the thickest. The general colour is a light fawn varied with darker fawn; the whole body covered with small fine hairs of a somewhat lighter colour closely set. Along the sides of the body are obliquely placed and parallel streaks at short intervals of a darker fawn than the general ground-colour, with a direction from the head downwards and backwards. At their lower extremities these streaks are connected together by a line of the same colour extending from the head to the anal extremity. The whole gives the appearance of a zigzag. Along the centre of the back a thin black line extends from the head to the tail. Half an inch from the head this line divides into two, enclosing a very narrow space about half an inch long, of a paler tint than the general ground-colour. From the central longitudinal black line run oblique streaks of the same colour as the oblique streaks on the sides of the body, and parallel with them, in a direction from the head downwards and backwards. A little in front of the centre of the body this longitudinal black line is interrupted by an oval patch of a buff colour which shows up very conspicuously. This patch is about one-third of an inch in length and one-eighth of an inch in width. The longitudinal dorsal line runs through the centre, but its colour is changed to dark brown within the patch. Springing from the central dorsal black line are what appear to be very sharp and thin pointed black spines standing vertically upwards. They are all very small, the longest of them scarcely more than one-eighth of an inch is always situated immediately in front of the oval buff-coloured patch before mentioned, and they spring from each junction of the segments of the body and gradually diminish in length as the head and tail are approached. On touching these formidable-looking spines I found them to be quite soft and easily bent. The head is of a lighter fawn colour than the rest of the body with darker markings and is covered thickly with short whitish hairs. Eight "horns" surround its edge, three on each side which are quite small at the lower part but gradually increase in length as the upper portion of the head is reached; and two on the summit of the head. These last two are

the longest and measure one-fifth of an inch in length. They are directed backwards, as are the others, and gradually diverge from each other, producing a V-like figure, the point of the V being at the attachment to the head. The anal extremity terminates in a forked appendage about half an inch in length, and closely covered with short whitish hairs. The prolegs are a bright reddish brown.

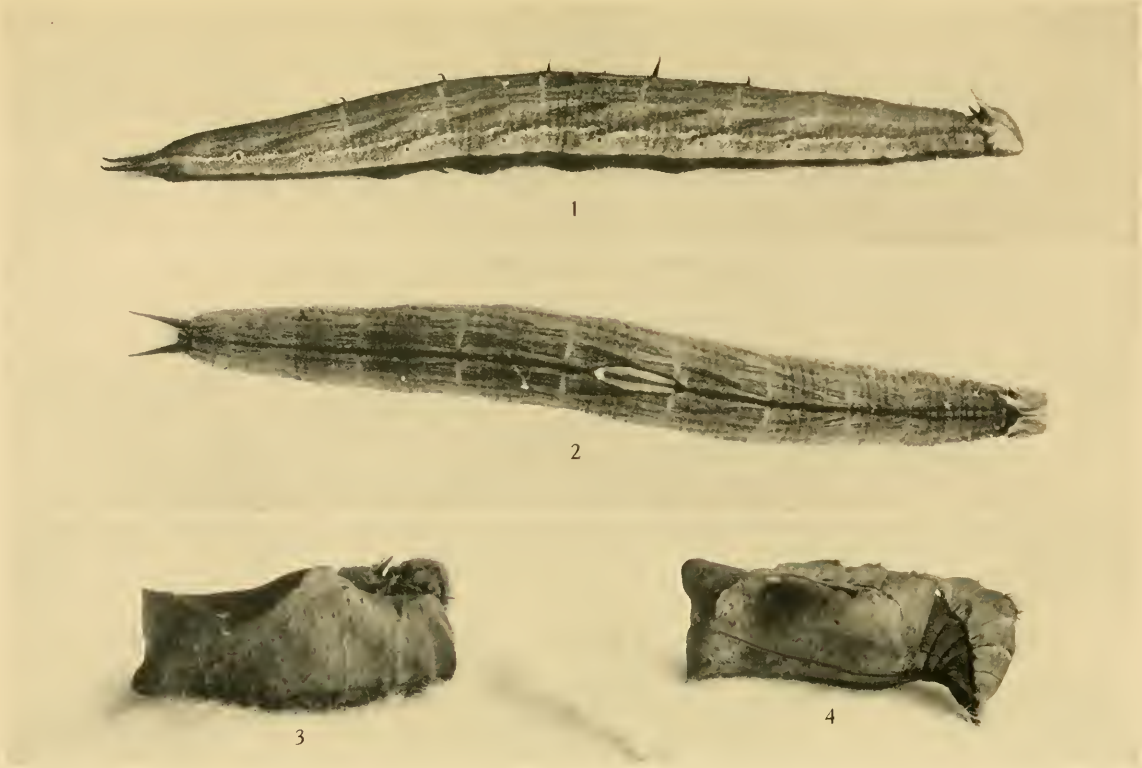
The pupa is 1½ inches in length; colour a yellow drab with blotches of grey irregularly scattered over it. The wing cases are rather strongly angled and stand out at right angles to the rest of the body. In the centre of the wing case, at its upper part is a double silver spot (!.) both parts of which are of small size but the upper is the larger. There is a well-marked thoracic hump on the dorsal surface. A thin dark brown line extends the whole length of the dorsum, and from this line and on each side of it spring tufts of very short small and fine black bristles.

Both pupae were photographed, and the photos accompany this Paper.

One imago emerged on the 12th January, 1915, but was, as I expected, malformed.

Explanation of Plate XXIX.

Figs. 1, 2. Larva of *Caligo memnon.*
3, 4. Pupa „ „



F. L. Davis, Photo. Andre, Sleigh & Anglo, Ltd.

LARVA AND PUPA OF CALIGO MEMNON, FELD.

VII. *Descriptions of South American* Micro-Lepidoptera.

By E. Meyrick, B.A., F.R.S.

[Read May 5th, 1915.]

I have here described a further selection of new forms from my collection, principally obtained by Mr. H. S. Parish. These include some examples of the high fauna of the Andes, collected at an elevation of over 12,000 feet, the only *Micro-Lepidoptera* yet described, I believe, from such an altitude, though I have in my hands for study some others obtained by the French explorers, MM. Alluaud and Jeannel, on Mt. Kenia in Africa at an elevation of over 13,000 feet. The Andine forms here described include the familiar European genera *Depressaria*, *Gracilaria*, *Bucculatrix*, and *Nepticula*, all found at the highest level. The further proposed exploration of these mountains was unfortunately interrupted by the outbreak of war.

Altogether in the present instalment 8 genera and 124 species are described as new.

GELECHIADAE.

Oecia oecophila, Staud.

Peru, Lima, in August (*Parish*). *Oecia maculata*, Wals., Proc. Zool. Soc. Lond., 1897, 111, is a synonym of this species, which is widely distributed (doubtless artificially); I have it also from India. It is a curious insect, of quite uncertain affinity at present, but probably allied to *Symmoca*; certainly not to *Endrosis*, which is Oecophorid.

Zelosyne olga, n. sp.

♂ ♀. 8–10 mm. Head white. Palpi white, second joint with dark fuscous basal and median bands, terminal joint with slender fuscous basal and median rings. Thorax bronzy-brown, with a white spot at posterior extremity. Abdomen dark grey, beneath yellow-ochreous with white segmental margins, anal tuft in ♂ whitish. Forewings elongate, narrow, costa slightly arched, strongly bent at ⅔, apex rounded-obtuse, termen extremely obliquely rounded; 7 and 8 stalked (not coincident as in *poecilosoma*); bronzy-brown; two broad snow-white fasciae edged with black, first extending on dorsum from near base to middle,

gradually narrowed upwards, second about $\frac{2}{3}$, narrowed on costa, anterior edge convex on upper half, posterior somewhat irregular; a suffused orange patch on lower part of termen; three or four dashes of blackish irroration on veins above this, confluent on apical margin; a fine oblique white strigula from costa at $\frac{3}{4}$: cilia grey, on costa and apex with basal half fulvous-orange and a fine whitish basal line, beyond this with two or three rows of black points opposite apex. Hindwings with 3 and 4 connate; grey, darker on veins and towards apex and termen, basal half hyaline except veins and a streak through middle of cell; cilia grey.

British Guiana, Bartica and Mallali, from January to March (*Parish*); ten specimens. I had unhesitatingly identified this conspicuous insect with *poecilosoma*, Wals., from Panama, regarding the neural differences as varietal; but having received through the kindness of Mr. A. Busck two fine examples of the latter species, I find that the characteristic distinctions of marking are unfortunately omitted in Lord Walsingham's description and not shown in the figure (Biol. Centr. Amer. IV, p. 51, pl. ii, f. 11); I therefore redescribe it beneath. The genus is a good one, though the two points on which stress is laid are the very two which are shown by the above species to be unreliable; it is allied rather to *Glyphidocera*.

Zelosyne poecilosoma, Wals.

♂. 11 mm. Head white. Thorax fulvous, with waved white transverse line before middle and white posterior spot edged anteriorly with blackish. Forewings with termen obliquely rounded (much less oblique than in *olga*); 7 and 8 coincident; fulvous-brown, towards tornus fulvous-ochreous; two broad snow-white fasciae as in *olga*, but black margins stronger, anterior convexity of second below middle; an elongate suffused white patch, resting on termen below middle; an oblique white strigula on costa at $\frac{4}{5}$, whence a narrow streak of very fine black and white transverse striation runs to termen below apex, costal space above this deep ferruginous: cilia as in *olga*. Hindwings rather dark grey, basal half hyaline except veins; an oval prismatic-hyaline tornal patch forming in reflected light an eye-shaped violet-crimson spot edged with pale blue; cilia grey.

Panama. The distinctive characters of the transverse thoracic line, the white subapical spot of forewings (indicated inaccurately in figure), the praeapical striated streak,

and beautiful coloured hyaline eye of hindwings are omitted in the original description. The terminal joint of palpi is considerably (not slightly) thickened with scales.

COSMOPTERYGIDAE.

Cosmopteryx pentachorda, n. sp.

♂♀. 9–10 mm. Head dark bronzy-fuscous, crown with three white lines, face bronzy. Palpi white lined with black. Antennae blackish, dotted and lined with white, two apical joints blackish, then two white, three blackish, one white, one blackish, one white. Thorax dark bronzy-fuscous with three white lines. Abdomen rather dark fuscous, segmental margins sometimes whitish. Posterior tibiae dark fuscous, with white lateral line from base to beyond middle, and white apical ring. Forewings narrow-lanceolate, apex very long-produced, caudate; dark bronzy-fuscous; fine white subcostal oblique and median lines from base, and subdorsal from beneath middle of these, all these nearly reaching band; costal edge white for some distance before band; dorsal edge white from base to near band; a broad ochreous-yellow post-median transverse band, marked with four pale golden-metallic spots, first on anterior edge above middle, followed by a black dot, second on dorsum posterior to first, just touching it at angle, thus cutting off a yellow spot, third and fourth within posterior margin, opposite, upper preceded by two or three black scales; from middle of yellow margin of band a white sinuate line runs to apex: cilia light grey, with white dash at apex and whitish costal spot on posterior margin of band. Hindwings and cilia light grey.

Ecuador, Huigra, 4500 feet, in June; Peru, Lima, 500 feet, and Chosica, 2800 feet, in July and August (*Parish*); six specimens.

Cosmopteryx tetragramma, n. sp.

♂♀. 8–9 mm. Head dark bronzy-fuscous, with very fine white lines above eyes, face silvery. Palpi white lined with blackish. Antennae blackish lined with white, four apical joints white, then five black, one white, one black, four white with dark fuscous basal spots. Thorax dark bronzy-fuscous. Abdomen rather dark bronzy-fuscous. Posterior tibiae dark fuscous with fine white lateral line on basal half and whitish apical ring. Forewings very narrowly lanceolate, apex slenderly long-produced, caudate; dark bronzy-fuscous; a very fine white somewhat oblique subcostal line from base to $\frac{1}{4}$; a very fine white median line from near base to $\frac{1}{3}$;

a very fine white subdorsal line from beneath apex of subcostal to rather near band; a very fine white subcostal line from $\frac{1}{3}$ to near band, and costal edge whitish for a short space before band; a broad ochreous-yellow postmedian transverse band, somewhat narrowed downwards, anterior edge marked with two golden-metallic spots, upper followed by a black dot, lower posterior, posterior edge marked by two golden-metallic opposite spots, with a broad irregular projection between them, from which a sinuate white line, yellow at base, extends along termen to apex: cilia grey, with white apical dash and whitish costal spot on posterior edge of band. Hindwings dark grey; cilia grey.

British Guiana, Bartica, Mallali, and Georgetown, from January to April (*Parish*); ten specimens. Nearest to *manipularis*.

Cosmopteryx citrinopa, n. sp.

♀. 9 mm. Head dark fuscous, crown with three fine white lines, face bronzy. Palpi white lined with black. Antennae black, dotted and lined with white, four apical joints white, then five black, one white, one black, one white. Thorax dark fuscous, with three fine white lines. Abdomen dark fuscous. Posterior tibiae blackish, with white oblique basal dash and median, subapical, and apical rings. Forewings narrow-lanceolate, apex long-produced, caudate; dark fuscous; a fine white subcostal line from base to $\frac{1}{4}$; rather short fine white median and subdorsal lines beneath apex of this, not nearly reaching base or band; costa slenderly white for a short space before band; a broad pale ochreous-yellowish postmedian transverse band, narrowed downwards, margined anteriorly by two silvery-metallic spots, upper followed by a black dot, lower posterior, and posteriorly by a rather inwards-oblique silvery-metallic fascia preceded by a few blackish scales, interrupted above middle by a slender projection of band, whence a fine sinuate white line runs to apex: cilia dark grey, with white apical dash and white costal spot on posterior margin of band. Hindwings and cilia dark grey.

Peru, Lima, 500 feet, in August (*Parish*); one specimen.

Cosmopteryx venefica, n. sp.

♂ ♀. 9–11 mm. Head dark bronzy-fuscous, crown with three fine white lines, face pale silvery-bronze. Palpi white lined with black. Antennae blackish, dotted and lined with white, four apical joints white, then five blackish, one white, one blackish, one white. Thorax dark bronzy-fuscous, with three fine white lines. Abdomen

light orange, sides and segmental margins shining grey, last two segments grey, anal tuft whitish-ochreous. Posterior tibiae blackish, with white basal, median, and apical rings. Forewings very narrowly lanceolate, apex long-produced, caudate; dark bronzy-fuscous; a fine oblique white subcostal line from base to about $\frac{1}{4}$, and rather short fine white median and subdorsal lines beneath apex of this, not nearly reaching base or band; costal edge white for a short space before band; a broad ochreous-yellow transverse postmedian band, narrowed downwards, margined anteriorly by a vertical golden-metallic fascia not quite reaching costa, followed by a black subcostal dot, and posteriorly by two golden-metallic spots preceded by two or three black scales, lower somewhat anterior, with an ochreous-yellow long projection between these continued as a gradually attenuated and whitening line to apex: cilia dark grey, with white apical dash and whitish costal patch on posterior edge of band. Hindwings and cilia dark grey.

Peru, Lima, 500 feet, in August (*Parish*); twelve specimens.

Cosmopteryx mimetis, Meyr.

British Guiana, Bartica, from December to February (*Parish*); four specimens. Apparently cosmopolitan in warm regions, and easily recognisable amongst its near allies by having the two apical joints of antennae black. The four preceding species are yellow-banded; this and the five following are orange-banded.

Cosmopteryx isotoma, n. sp.

♂♀. 9 mm. Head dark bronzy-fuscous, with fine white lines above eyes, face lighter. Palpi white lined with black. Antennae black lined with white, four apical joints white, then five (in ♀ four) black, four (in ♀ five) white. Thorax dark fuscous, with three fine white lines. Abdomen dark fuscous. Posterior tibiae dark fuscous, with white basal, median, and apical rings, and silvery-metallic subapical. Forewings very narrowly lanceolate, apex long-produced, caudate; blackish; a fine oblique white subcostal line from base to $\frac{1}{4}$; short fine white median and subdorsal lines beneath apex of this, widely remote from base and band; a broad light orange postmedian transverse band, margined anteriorly by a vertical golden-metallic fascia followed by a black subcostal dot, and posteriorly by two golden-metallic spots preceded by some blackish scales, lower slightly anterior, with a moderate pointed orange projection between them, whence a fine somewhat interrupted silvery-white line runs to apex: cilia dark fuscous, with a

white apical dash, and white costal spot on posterior margin of band. Hindwings and cilia dark fuscous.

British Guiana, Bartica, in December and February (*Parish*); two specimens. Much like the following species, but larger, and distinguished from all by the broad antepenultimate white band of antennae.

Cosmopteryx erasmia, n. sp.

♂ ♀. 7–8 mm. Head dark fuscous, crown with three fine white lines, face bronzy. Palpi white lined with black. Antennae blackish lined with white, four apical joints white, then five black, one white, one black, two white. Thorax dark fuscous, with three fine white lines. Abdomen dark fuscous. Posterior tibiae black, with silvery-metallic basal, median, and subapical rings, and white apex. Forewings narrow-lanceolate, apex long-produced, caudate; blackish; dorsal edge very finely white towards base; a fine oblique white subcostal line from very near base to $\frac{1}{4}$; short fine white median and subdorsal lines beneath apex of this, widely remote from base and band; a broad orange transverse postmedian band, margined anteriorly by a vertical golden-metallic fascia not quite reaching costa and followed by a black subcostal dot, and posteriorly by two golden-metallic rather oblique spots edged anteriorly with blackish, lower rather anterior, with a narrow pointed orange projection between them, whence a more or less interrupted slender silvery-white streak runs to apex: cilia dark fuscous, with a white apical dash, and a white costal spot on posterior margin of band. Hindwings and cilia dark fuscous.

British Guiana, Bartica, from February to April (*Parish*); four specimens. Extremely similar to *mimetis*, but rather smaller, and immediately distinguished by white apex of antennae.

Cosmopteryx thrasyzela, n. sp.

♂ ♀. 7–8 mm. Head dark bronzy-fuscous, crown with three fine white lines, face metallic-bronze. Palpi white lined with black. Antennae blackish lined with white, four apical joints white, then five black, one white, one black, one white. Thorax blackish, with three fine white lines. Abdomen dark fuscous. Posterior tibiae black, with silvery-metallic basal, median, subapical, and apical rings. Forewings narrow-lanceolate, apex long-produced, caudate; blackish; a fine oblique white subcostal line from near base to $\frac{1}{6}$; short fine white median and subdorsal lines beneath apex of this,

widely remote from base and band, median shortest; a short extremely fine white dash just below costa near band; a broad orange transverse postmedian band, margined anteriorly by a vertical violet-golden-metallic fascia followed by a black subcostal dot, and posteriorly by two prismatic-golden-metallic transverse spots edged anteriorly with blackish, lower wholly anterior to upper but just touching it at angle; a very short violet-white mark midway between this and apex, and a short silvery-white dash at apex: cilia dark fuscous, with a white apical dash, and white costal spot on posterior edge of band. Hindwings and cilia dark fuscous.

British Guiana, Bartica, from February to April (*Parish*); five specimens. Most like *belonacma*, but without orange posterior projection of band.

Cosmopteryx teligera, n. sp.

♂♀. 8 mm. Head dark bronzy-fuscous, crown with three fine white lines, face bronzy. Palpi white lined with black. Antennae blackish, dotted and lined with white, four apical joints white, then five black, one white, one black, one white. Thorax dark bronzy-fuscous, with three fine white lines. Abdomen dark fuscous. Posterior tibiae blackish, with silvery-white basal dash and median, subapical, and apical rings. Forewings very narrowly lanceolate, apex long-produced, caudate; blackish; a fine oblique silvery-white subcostal line from near base to about $\frac{1}{4}$, and short fine silvery-white median and subdorsal lines beneath apex of this, not nearly reaching base or band; a broad orange transverse post-median band, narrowed downwards, margined anteriorly by a vertical violet-golden-metallic fascia followed by a black subcostal dot, and posteriorly by two violet-golden-metallic rather oblique spots edged anteriorly with blackish, lower anterior but just touching upper at angle; a short fine silvery-white apical dash: cilia dark fuscous, with white apical dash and white costal spot on posterior margin of band. Hindwings and cilia dark fuscous.

Colombia, Cali, 500 feet, in May (*Parish*); two specimens.

Cosmopteryx tenax, n. sp.

♂. 10 mm. Head dark bronzy-fuscous, with fine white lines above eyes, face pale silvery-bronze. Palpi white lined with black. Antennae dark grey, towards base blackish dotted and lined with white, four apical joints and tenth and twelfth obscurely mixed with whitish. Thorax dark bronzy-fuscous, with three fine white lines. Abdomen dark fuscous. Posterior tibiae blackish, with silvery-

metallic basal, median, and subapical rings, and white apex. Forewings very narrowly lanceolate, apex long-produced, caudate; dark bronzy-fuscous; a very fine oblique white subcostal line from base to beyond $\frac{1}{4}$; short fine white median and subdorsal lines beneath apex of this, widely remote from base and band; costal edge white for a short space before band; a broad orange transverse postmedian band, narrowed downwards, margined by entire violet-golden-metallic fasciae, anterior vertical, followed by a black subcostal dot, posterior inwards-oblique, preceded by a few blackish scales; a very fine interrupted silvery-white line in apical fifth, not nearly reaching band: cilia dark fuscous, with white apical dash and white costal spot on posterior margin of band. Hindwings and cilia dark fuscous.

Colombia, La Crumbre, 6600 feet, in May (*Parish*); one specimen.

Cosmopteryx nyctiphanes, n. sp.

♂♀. 7–8 mm. Head bronzy-blackish, with fine whitish lines above eyes, face bronzy-whitish. Palpi white lined with black. Antennae blackish, towards base lined with white, with a whitish band at $\frac{3}{4}$. Thorax bronzy-black. Abdomen blackish. Posterior tibiae black banded with bluish-silvery-metallic, bristly tufts considerably longer than usual. Forewings very narrowly lanceolate, apex long-produced, caudate; black; three narrow pale prismatic-violet-golden metallic fasciae, first at $\frac{1}{4}$, slightly oblique, tending to be broken up, followed by a fine subdorsal dash, second median, direct, third at $\frac{3}{4}$, rather inwards-oblique, forming a white spot on costa, sometimes slightly interrupted in disc; a short violet-silvery-white dash on termen midway between third fascia and apex: cilia dark grey, with a white spot or dash at apex, and a white costal spot on third fascia. Hindwings and cilia dark grey.

Ecuador, Huigra, 4500 feet, in June (*Parish*); eight specimens. In this species the metallic margins of the band are in their usual positions, but the band is black just as the ground-colour.

OECOPHORIDAE.

Erysiptila, Meyr.

Head smooth-scaled, sidetufts roughly spreading; ocelli absent; tongue developed. Antennae $\frac{3}{4}$, in ♂ moderately ciliated (1), basal joint moderately elongate, flattened, with thin pecten. Labial

palpi long, recurved, second joint considerably thickened with scales, with dense rough projecting brush or short tuft of scales beneath, terminal joint somewhat shorter than second, thickened with scales, posteriorly prominent towards apex, pointed. Maxillary palpi very short, filiform, appressed to tongue. Anterior tarsi somewhat thickened with scales; posterior tibiae with long fine hairs above, and rough-scaled beneath. Forewings with tufts of raised scales; 2 from $\frac{1}{5}$, 3 from angle, 7 and 8 stalked, 7 to costa, 11 from beyond middle. Hindwings 1, elongate-trapezoidal, cilia $\frac{3}{4}$; 3 and 4 stalked, 5 somewhat approximated at base, 6 and 7 parallel, cell and area immediately beyond and beneath it hyaline, with veins fringed with long projecting scales.

By the kindness of Mr. A. Busck I have received a fine example of the type of this genus, *Clevelandi*, Busck, and am therefore enabled to give the full characters of the genus, which is in fact very distinct from *Borkhausenia*; the structure of palpi, scale-tufts of forewings, form and neuration of hindwings all indicate a nearer relationship to the New Zealand *Izatha*.

Machimia entaphrota, n. sp.

♂. 12 mm. Head ochreous-grey-whitish. Palpi white, lower $\frac{2}{3}$ of second joint grey irrorated with dark fuscous. Antennal ciliations 6. Thorax grey mixed with grey-whitish. Abdomen grey. Forewings elongate, somewhat dilated posteriorly, costa gently arched, apex obtuse, termen obliquely rounded; grey sprinkled with whitish; a streak of blackish irroration along basal fourth of costa; stigmata blackish, plical beneath first discal, these two placed on anterior edge of a darker antemedian fascia sprinkled with blackish and without whitish irroration; a strongly curved subterminal series of blackish dots from $\frac{3}{4}$ of costa to tornus, and an additional dot on dorsum towards tornus: cilia pale greyish-ochreous. Hindwings pale grey, darker posteriorly; cilia pale greyish-ochreous.

Colombia, La Crumbre, 6600 feet, in May (*Parish*); one specimen. Nearest to *speculatrix*.

Filinota rhodographa, n. sp.

♀. 17 mm. Head pale grey-yellowish, crown crimson. Palpi whitish-yellowish. Antennae whitish, basal half suffused with rosy, with a grey band above middle and another before apex. Thorax pale grey-yellowish, anterior margin and shoulders dark

grey, patagia with a crimson strigula behind this. Abdomen white. Forewings elongate, rather narrow, costa slightly arched, apex obtuse, termen obliquely rounded; 4 absent, 7 to apex; dark grey; a brassy-golden-yellow streak along costa interrupted by ground colour at $\frac{1}{4}$, its lower edge with a projection in middle terminated by a crimson dot, continued round apex and termen to below middle and then curved in along vein 3 to angle of cell; beyond cell an elongate silvery-white patch edged with crimson; erect triangular silvery-white blotches edged with crimson on dorsum at $\frac{1}{4}$ and before termen, reaching more than half across wing; between these an irregular-oval yellow blotch in disc, edged beneath by a crimson mark: cilia yellowish, tinged with rosy towards tornus. Hindwings and cilia white.

British Guiana, Mallali, in March (*Parish*); one specimen. The genus *Lupercalia*, Busck, cannot be maintained as distinct from *Filinota*.

Depressaria mesosceptra, n. sp.

♂. 21 mm. Head, palpi, and thorax whitish-ochreous. Abdomen whitish-ochreous-grey. Forewings elongate, rather narrow, costa gently arched, apex obtuse, termen very obliquely rounded; 2 and 3 stalked; whitish-ochreous, with a few scattered blackish specks; a narrow somewhat irregular-edged median fuscous streak irrorated with blackish almost from base to apex but not quite reaching either: cilia ochreous-grey-whitish. Hindwings whitish-grey; cilia ochreous-grey-whitish.

Peru, Oroya, 12,200 feet, in July (*Parish*); one specimen.

Depressaria significa, n. sp.

♂ ♀. 19–20 mm. Head fuscous somewhat sprinkled with whitish. Palpi whitish sprinkled with pale ochreous, grey, and dark fuscous, with subapical band of second joint, and subbasal and supramedian bands of terminal joint of dark fuscous suffusion, in ♀ little marked. Thorax brownish mixed with fuscous, somewhat sprinkled with dark fuscous and whitish. Abdomen fuscous mixed with darker, apex pale ochreous. Forewings elongate, rather narrow, costa gently arched, apex obtuse, termen very obliquely rounded; 2 and 3 stalked; brownish mixed with grey, tips of scales very finely whitish, with scattered blackish scales tending to form blackish-grey strigulae, costa and dorsum distinctly strigulated with blackish; first discal stigma black, just beyond and beneath it is a short black dash edged above with whitish, second discal white ringed with

blackish, plical very small, black, beneath first discal: cilia light brownish, towards base mixed with fuscous, all scales finely whitish-tipped. Hindwings light grey, darker towards apex, veins darker; cilia whitish-ochreous tinged with grey, with greyish basal and postmedian lines.

Ecuador, Alausi, 9450 feet, in June (*Parish*); two specimens.

Depressaria lusciosa, n. sp.

♂. 20–21 mm. Head pale brownish irrorated with whitish. Palpi brown-whitish, sprinkled with blackish towards base, with blackish subapical ring of second joint, and basal and supramedian rings of terminal joint. Thorax light brownish suffusedly irrorated with whitish. Abdomen whitish-ochreous, suffusedly banded with grey. Forewings elongate, rather narrow, costa gently arched, apex rounded-obtuse, termen obliquely rounded; 2 and 3 stalked; brownish or fuscous, tips of scales whitish, with scattered dark fuscous scales tending to form strigulae, costa more or less strigulated with blackish; first discal stigma blackish, with a less marked dot of brown and blackish scales somewhat beyond and beneath it, second discal white, without dark edging: cilia light brownish or greyish, irrorated with whitish. Hindwings pale grey; cilia ochreous-grey-whitish.

Peru, Jauja, 11,900 feet, in July (*Parish*); two specimens. Allied to *significa*.

Cryptolechia loxobathra, n. sp.

♂. 8 mm. Head whitish-ochreous, sidetufts mixed with dark fuscous. Palpi whitish, second joint suffusedly irrorated with dark fuscous except towards apex. Thorax dark fuscous. Abdomen grey, anal tuft pale ochreous. Forewings elongate, costa gently arched, apex obtuse, termen obliquely rounded; 8 and 9 out of 7; whitish-ochreous; a dark fuscous basal fascia, narrow on dorsum, widest on costa, where it extends to $\frac{1}{5}$; discal stigmata dark fuscous, first minute, second moderate; a few dark fuscous scales towards dorsum at $\frac{4}{5}$; a dark fuscous spot on costa beyond $\frac{2}{3}$; a dark fuscous fasciaform blotch extending along termen from apex to below middle: cilia whitish-ochreous, towards tornus tinged with grey. Hindwings light grey; cilia grey-whitish.

British Guiana, Mallali, in March (*Parish*); one specimen.

HELIODINIDAE.

Percnarcha, n. g.

Head smooth; ocelli present; tongue developed. Antennae $\frac{1}{8}$, stout, scaled, in ♂ moderately strongly ciliated, in ♀ fringed with rough projecting scales above, basal joint moderate, without pecten. Labial palpi very long, recurved, with appressed scales, terminal joint longer than second, acute. Maxillary palpi obsolete. Posterior tibiae smooth-scaled, with whorls of expanded bristly scales at origin of spurs, spurs roughened with scales above, tarsi thickened with scales, with short bristles at apex of joints. Forewings with 2 from towards angle, 3 and 4 approximated from angle, 7 and 8 stalked, 7 to costa, 11 from middle. Hindwings 1, elongate-trapezoidal, somewhat dilated posteriorly, apex obtuse, termen rounded, cilia $\frac{1}{3}$; 3 and 4 connate, 5 somewhat approximated, 6 and 7 approximated towards base.

Type *trabeata*, Meyr., from Bolivia, wrongly attributed to *Tinaegeria*, which belongs to the *Sesiadae*.

Percnarcha rhodosoma, n. sp.

♀. 23 mm. Head, palpi, antennae, and thorax deep glossy indigo-purple-blue, antennae with rough scales longest between middle and $\frac{3}{4}$, apical fourth simple, white. Abdomen rosy-crimson, two basal segments, apical, and most of praeapical deep indigo-purple, ventral surface of two basal segments blotched with pale ochreous. Posterior tibiae red, basal and apical bands and tarsi deep indigo-blue, tarsi fringed above with rough projecting scales. Forewings elongate, very narrow anteriorly, moderately dilated posteriorly, costa somewhat sinuate, posteriorly gently arched, apex obtuse-pointed, termen very obliquely rounded; deep glossy indigo-bluish-purple; submedian fold and dorsum suffused with fuscous anteriorly: cilia dark purplish-grey. Hindwings pale whitish-ochreous, with a hyaline patch extending along termen from base to about vein 4, and a dark purple-grey patch occupying apical fourth, and sending a streak inwards in middle to cell; veins 2–4, and terminal edge from near base to apical patch dark fuscous: cilia dark grey, becoming whitish-ochreous towards dorsum.

British Guiana, Bartica, in February (*Parish*); one specimen.

Heliodines choneuta, n. sp.

♂ ♀. 8–10 mm. Head, palpi, and thorax dark shining bronzy-grey. Abdomen dark grey. Forewings lanceolate, apex somewhat

produced, acute; 3 absent, 6 and 8 stalked; deep shining bronze, largely suffused with dark shining leaden-grey, but without defined markings: cilia dark grey. Hindwings and cilia dark fuscous; 3 absent.

COLOMBIA, Cali, 500 feet, and Caldas, 4400 feet, in May (*Parish*); eight specimens. Vein 3 is absent in both wings, as well as the other veins normally absent in the genus, but the species is a true *Heliodines*.

Lamprolophus obolarcha, Meyr.

COLOMBIA, Cali, 500 feet, and Caldas, 4400 feet; ECUADOR, Huigra, 4500 feet; in May and June (*Parish*), common. Varies remarkably in size, down to 7 mm.; basal half of forewing sometimes much suffused with blackish. *Embola dentifera*, Wals., Biol. Centr. Am., IV, p. 4, pl. i, f. 6 (1909), from Mexico, is clearly a synonym; the genus *Embola* does not seem properly distinguishable from *Lamprolophus*.

CYPHACMA, n. g.

Head smooth; ocelli present; tongue short. Antennae $\frac{3}{4}$, in ♂ simple, basal joint elongate, without pecten. Labial palpi long, slender, filiform, curved, ascending, terminal joint somewhat shorter than second, pointed. Maxillary palpi obsolete. Posterior tibiae with rough projecting bristly hairs above, tarsi with very short bristles at apex of joints. Forewings with apex strongly bent down as though deformed; 1*b* simple, 2 from angle, 3–5 absent, 6 and 8 stalked, 7 absent, 9 out of 8 near base, cell open between 9 and 10, 11 from middle. Hindwings $\frac{1}{3}$, linear-lanceolate, cilia 6; 3–5 absent, cell open between 2 and 6, 6 and 7 connate.

Cyphacma chalcozela, n. sp.

♂ ♀. 5–6 mm. Head and thorax shining metallic-bronze. Palpi grey-whitish. Abdomen dark grey. Forewings lanceolate, apex caudulate; brilliant metallic bronze: cilia dark grey, base scaled with metallic-bronzy. Hindwings and cilia dark grey.

COLOMBIA, Cali, 500 feet, in May; ECUADOR, Huigra, 4500 feet, in June; PERU, Lima, 500 feet, in August (*Parish*); fourteen specimens. This is a very singular little insect; the deflexed apex of forewing (giving a bluntly-rounded convex aspect very different to its real shape as seen when denuded and flattened out) and metallic brilliance

suggest that in life there must be considerable resemblance to a small Phytophagous Coleopteron.

ENCAMINA, n. g.

Head smooth; ocelli conspicuous; tongue developed. Antennae (apex broken) thickened with scales, in ♂ shortly ciliated, basal joint moderate, without pecten. Labial palpi moderately long, curved, ascending, with appressed scales somewhat roughened anteriorly, terminal joint longer than second, pointed. Maxillary palpi rudimentary. Posterior tibiae somewhat loosely scaled above, tarsi rather densely scaled, with very short bristles at apex of joints. Forewings with 2 from near angle, 3 and 4 closely approximated from angle, 7 to termen, 11 from before middle. Hindwings $\frac{4}{5}$, elongate-ovate, cilia $\frac{1}{3}$; 2 remote, 3 and 4 connate from angle, 5 parallel, 6 and 7 nearly approximated towards base.

Encamina phlegyropa, n. sp.

♂. 24 mm. Head, palpi, and thorax glossy dark indigo-fuscous, patagia deep ferruginous-reddish. Abdomen deep red, apical third dark indigo-fuscous. Posterior tibiae red, apex and tarsi dark indigo-fuscous. Forewings elongate, narrow, somewhat dilated posteriorly, costa somewhat sinuate, slightly arched posteriorly, apex rounded, termen obliquely rounded; dark indigo-fuscous; an irregular crimson-red basal spot, not quite reaching costa or dorsal edge: cilia purplish-fuscous. Hindwings dark violet-fuscous; an orange-red basal patch occupying $\frac{2}{3}$ of wing but not reaching termen except at base, included hairs of 1*b* dark fuscous; cilia violet-fuscous.

BRITISH GUIANA, Bartica, in February (*Parish*); one specimen.

CREMBALASTIS, n. g.

Head smooth; ocelli present; tongue developed. Antennae almost 1, stout, simple, basal joint short, without pecten. Labial palpi moderate, curved, porrected, with appressed scales, terminal joint longer than second, pointed. Maxillary palpi rudimentary. Posterior tibiae loosely scaled above, basal joints of tarsi with very short apical bristles. Forewings with 2 from angle, 7 absent, 11 from middle. Hindwings $\frac{2}{3}$, elongate-lanceolate, cilia 2; 2 remote, 3 from angle, 4 absent, 5 absent, 6 and 7 rather approximated towards base.

Crembalastis erythrorma, n. sp.

♂ ♀. 10–13 mm. Head, palpi, antennae, thorax, and abdomen glossy dark violet-fuscous. Forewings elongate, narrow, costa

somewhat sinuate, posteriorly slightly arched, apex tolerably pointed, termen very obliquely rounded; glossy dark violet-fuscous; a variable irregular orange-red subbasal fascia, often reduced to a costal spot: cilia dark grey, towards base dark violet-fuscous. Hindwings dark fuscous; cilia dark grey.

Peru, Lima, 500 feet, in August (*Parish*); ten specimens.

GLYPHIPTERYGIDAE.

Ordrupia fabricata, n. sp.

♂. 31 mm. Head and thorax whitish-ochreous. Palpi brownish-ochreous. Abdomen pale ochreous suffused with grey. Forewings elongate-triangular, costa straight, apex obtuse, termen straight, rather oblique; light brownish-ochreous; posterior end of cell clouded with fuscous, and a semioval blotch of fuscous suffusion extending over posterior half of dorsum; a fuscous dot in cell before its middle, one on lower angle, and a transverse mark on upper angle; terminal edge infuscated: cilia light ochreous-fuscous. Hindwings ochreous-grey-whitish; cilia whitish.

British Guiana, R. Demerara; Dutch Guiana, R. Saramacca, in May; two specimens.

Imma prasinospora, n. sp.

♂. 28 mm. Head fuscous, orbits marked with white. Palpi stout, obtuse, rather dark fuscous, base and apex of second joint white. Antennal ciliations 1. Thorax fuscous mixed with lilac-grey, shoulders with a light brownish spot surrounded with blackish suffusion. Abdomen fuscous, beneath whitish. Thorax and femora beneath clothed with white hairs. Forewings somewhat elongate-triangular, costa gently arched, apex rounded-obtuse, termen rather obliquely rounded; 7 and 8 separate, 8 to costa; rather dark brownish, somewhat sprinkled irregularly with whitish-green and blackish; a subcostal series of four or five black dashes from base to $\frac{2}{3}$; blackish marks on costa at $\frac{1}{4}$ and before middle, and three together about $\frac{3}{4}$; curved interrupted blackish lines crossing disc about $\frac{2}{5}$ and $\frac{3}{4}$, space between these suffusedly mixed with light green, extended below middle to base; an oblique white mark beyond lower angle of cell, with a black spot above it; an irregular black spot towards termen in middle; some light green irroration above tornus; a nearly continuous series of black marks just before termen, and terminal obscure whitish-tinged dots between these: cilia rather dark fuscous, on termen with some indistinct light

brownish bars. Hindwings dark fuscous, lighter anteriorly; dorsum white, folded over beneath, fold clothed inside with long ochreous-yellowish hairs; cilia whitish-fuscous, with dark fuscous subbasal shade.

Ecuador, Huigra, 4500 feet, in January (*Parish*); one specimen.

Simaethis ophiodesma, n. sp.

♂. 20–21 mm. Head fuscous. Palpi with appressed scales, light yellowish-grey, white internally. Thorax fuscous, edges of patagia anteriorly suffused with whitish. Abdomen fuscous. Forewings triangular, costa slightly arched, apex pointed, termen sinuate beneath apex, bowed, hardly oblique; fuscous; some whitish irroration at base; two narrow transverse fasciae of whitish irroration, first about $\frac{1}{3}$, hardly curved, second slightly beyond middle, straight, well-defined anteriorly but suffused posteriorly; a third less-developed similar fascia from $\frac{3}{4}$ of costa to tornus represented only by dorsal half and a spot on costa; an ochreous-orange S-shaped streak in disc posteriorly, sending a slender streak from its upper curve to costa before apex, thence round apex and termen to tornus, where it almost joins an oblique-longitudinal subdorsal dash, upper half of terminal portion edged anteriorly by a silvery-leaden-metallic line: cilia metallic leaden-grey, with black basal line, on costa fuscous. Hindwings fuscous, darker posteriorly; a longitudinal patch of ochreous-yellow suffusion or irroration in disc above middle; a slender orange streak along termen throughout; cilia light grey, towards tips white, with dark fuscous basal and whitish subbasal lines.

Peru, Contamano, R. Ucuyali, in December, and Chanchamayo, in January (*Mounsey*); two specimens.

Simaethis brachymorpha, n. sp.

♂. 11 mm. Head brown speckled with dark fuscous, face yellowish-tinged. Palpi ochreous-yellowish sprinkled with fuscous except towards base. Antennal ciliations 3. Thorax and abdomen dark fuscous. Forewings triangular, costa gently arched, apex obtuse, termen somewhat bowed, little oblique; dark brown mixed with dark fuscous; six indistinct fasciae of whitish irroration, first basal, second at $\frac{1}{5}$, third at $\frac{2}{5}$, slightly curved, fourth and fifth forming white spots on costa, fourth curved outwards in disc, so as to coalesce with fifth, fifth from $\frac{3}{4}$ of costa to tornus, sixth terminal, widest at apex, attenuated to just above tornus: cilia fuscous, with dark fuscous basal line, mixed with whitish on costa and on patches

above and below middle of termen. Hindwings with tornus prominent; dark fuscous; a fine short irregular whitish line from dorsum before tornus parallel to termen; cilia whitish-fuscous, with dark fuscous basal line.

Bolivia, Songo, 6500 feet; one specimen. Allied to *fabriciana*, but much shorter-winged.

Brenthia acmogramma, n. sp.

♂ ♀. 13–14 mm. Head dark fuscous, white before and behind eyes. Palpi white, with subapical ring of second joint, and base and an anterior streak of terminal joint blackish, in ♂ with blackish scale-tuft from basal joint beneath. Antennal ciliations of ♂ 1. Thorax dark fuscous, with a whitish mark on inner side of shoulder. Abdomen dark fuscous. Forewings elongate-triangular, costa gently arched, apex rounded, termen slightly rounded, hardly oblique; rather dark fuscous; base and a subbasal shade lighter, sometimes whitish-tinged; a slightly curved transverse lighter shade at $\frac{1}{4}$, more or less mixed with whitish suffusion; moderately broad partially confluent transverse fasciae of whitish irroration in middle and at $\frac{3}{4}$, between which in disc is a narrow-transverse spot of ground colour outlined with white, preceded by a dark fuscous spot and followed by two small ones, second fascia forming a small whitish spot on costa beyond $\frac{3}{4}$; patches of pale violet-blue-metallic irroration on costa at $\frac{1}{4}$ and $\frac{1}{2}$, and beneath costa at $\frac{3}{4}$; a black marginal band round apex and termen, anterior edge irregular, deeply indented near upper end and sometimes in middle also, including a pale violet-blue-metallic praemarginal continuous line with eight or nine fine acute projections inwards: cilia fuscous with dark fuscous subbasal line, above tornus with a small whitish spot on outer half. Hindwings dark fuscous; an oblique-oval lighter fuscous spot in disc before middle; an inwardly oblique whitish mark from costa at $\frac{3}{4}$; a short indistinct whitish transverse line from tornus; a transverse white streak towards termen in middle; a transverse violet-blue-metallic streak across apex, and a dot near termen below middle; cilia fuscous, with dark fuscous subbasal line, and broad oblique white apical, median, and tornal patches.

Bolivia, Songo, 6500 feet; four specimens. Finding that my series of supposed South American examples of *pavonacella* was assuming a heterogeneous aspect, I made a more critical examination, and conclude that I have no reason to believe that *pavonacella* occurs in South America at all, being represented there by a group of closely allied similar species, mistaken for it by myself and others.

Brenthia monolychna, n. sp.

♂♀. 11–12 mm. Head dark fuscous, orbits white except above. Palpi white, with subapical ring of second joint, and base and an anterior streak of terminal joint dark fuscous, in ♂ with fine dark fuscous projecting scale-pencil from basal joint beneath. Antennal ciliations in ♂ 1½. Thorax and abdomen dark fuscous. Forewings elongate-triangular, costa gently arched, apex rounded, termen slightly rounded, hardly oblique; dark fuscous; a slightly curved transverse lighter shade at ¼, sometimes partially whitish-tinged, marked with violet-blue-metallic on costa and in middle; a violet-blue-metallic streak just below costa in middle; three irregular transverse lines of whitish irroration on dorsal half of wing between middle and tornus; a narrow transverse spot of ground colour outlined with white in disc beyond middle; a violet-blue-metallic dash running from top of this to terminal fascia; a white dot on costa at ¾; a broad black terminal fascia, in middle occupying ⅓ of wing but rounded off to extremities, including a conspicuous white dot or transverse mark in middle and a deep golden-violet-metallic praemarginal streak bearing uneven triangular projections inwards, finely interrupted below apex: cilia rather dark fuscous, with darker subbasal line, and white spots on outer half at apex and above tornus. Hindwings dark fuscous; a small cloudy whitish spot in disc towards base; an oblique-oval whitish-fuscous spot in disc before middle; an inwardly oblique whitish mark from costa at ¾; a short indistinct whitish transverse line from tornus; a transverse white streak towards termen in middle, its lower end touching termen; a golden-violet-metallic streak across apex; cilia dark fuscous, with oblique white apical, median, and tornal patches.

British Guiana, Bartica, in January and February (*Parish*); four specimens.

Brenthia ceutholychna, n. sp.

♂♀. 9–10 mm. Head bronzy-fuscous, orbits white except above. Palpi white, with two rings of second joint, and base and an anterior streak of terminal joint dark fuscous, in ♂ with short fine dark fuscous projecting scale-pencil from basal joint beneath. Antennal ciliations of ♂ 1. Thorax dark fuscous, with very fine whitish lines on shoulder and inner edge of patagia. Abdomen dark fuscous. Forewings elongate-triangular, costa gently arched, apex rounded-obtuse, termen slightly rounded, hardly oblique; dark fuscous; base and a fascia at ⅕ lighter, whitish-sprinkled; a transverse-oval spot of ground colour outlined with whitish irroration in disc beyond middle, preceded and followed by very indefinite fasciae of scanty

whitish irroration, obsolete on costa, posterior one often making a whitish spot on dorsum; a longitudinal streak of violet-blue-metallic irroration extending above discal spot from before middle to terminal band; a moderate black terminal band, in middle occupying less than $\frac{1}{4}$ of wing, anterior edge acutely indented opposite apex of wing, edged on upper half by a whitish irregular line from $\frac{3}{4}$ of costa, and enclosing a violet-golden-metallic praemarginal toothed line tending to be broken into spots and always strongly interrupted beneath apex: cilia light fuscous, with dark fuscous subbasal line, without white patches. Hindwings dark fuscous; a whitish-fuscous oblique-oval spot in disc before middle; an inwardly-oblique white mark from costa at $\frac{3}{4}$; a short indistinct obliquely curved whitish mark from tornus; a white transverse streak towards termen in middle, its lower end touching termen; a golden-violet-metallic streak across apex; cilia dark fuscous, with obscure oblique grey-whitish apical, median, and tornal patches.

British Guiana, Bartica and Mallali, from January to April (*Parish*); Peru, Pacaya, in July (*Mounsey*); twenty specimens. Easily known from *pavonacella* by the absence of white patch in apical cilia of forewings.

Brenthia stenorma, n. sp.

♂. 13 mm. Head rather dark fuscous, orbits white except above. Palpi white, with subapical ring of second joint, and base and an anterior streak of terminal joint dark fuscous, with short rough tuft of dark fuscous scales from basal joint beneath. Antennal ciliations $1\frac{1}{2}$. Thorax dark fuscous (injured). Forewings elongate-triangular, costa gently arched, apex rounded, termen slightly rounded, hardly oblique; dark fuscous; base and an irregular curved fascia at $\frac{1}{4}$ lighter, slightly whitish-sprinkled; a transverse-oval spot of ground colour outlined with white in disc beyond middle, preceded by a darker fuscous spot and followed by two small ones, and also preceded and followed by very undefined fasciae of whitish irroration obsolete towards costa, posterior more whitish-suffused towards dorsum; some pale blue-metallic irroration on both these fasciae beneath costa, and a streak of pale blue-metallic irroration from top of discal spot to terminal band; a narrow black terminal band, only occupying $\frac{1}{6}$ of wing in middle, anterior edge irregular, acutely indented opposite apex and in middle, preceded on upper half by an irregular whitish line from $\frac{3}{4}$ of costa sending projections into indentations, and enclosing a golden-violet-metallic praemarginal line with narrow wedgeshaped

projections inwards, interrupted beneath apex: cilia light fuscous, with dark fuscous subbasal line, without white patches. Hindwings dark fuscous; a lighter fuscous oblique-oval spot in disc before middle; an inwardly-oblique white mark from costa at $\frac{3}{4}$; an indistinct transverse whitish mark from tornus; a white transverse streak towards termen in middle, its lower end touching termen; a golden-violet-metallic streak across apex: cilia dark fuscous, with oblique whitish apical, median, and tornal patches.

Brazil, Parana; one example received from Mr. A. Busck as *pavonacella*. Recognisable by the narrow terminal band and absence of white patches in cilia of forewings. The true *pavonacella* has the terminal band almost equally narrow, edged anteriorly by a small distinct white spot in middle, and a white apical patch in cilia of forewings; the discal spot of hindwings is more or less suffused with white; it is a small species, 10–11 mm.

Choreutis lapidaria, Meyr.

Peru, Huancayo, 10,650 feet, and Lima, 500 feet, in July and August; common (*Parish*). This range in elevation is curious, but the specimens are certainly the same species.

Choreutis cydrota, n. sp.

♂. 13 mm. Head and thorax grey finely irrorated with white. Palpi white, mixed with dark grey except towards base. Antennal ciliations $2\frac{1}{2}$. Abdomen dark grey, segmental margins sprinkled with whitish. Forewings rather elongate-triangular, costa gently arched, apex obtuse, termen rounded, somewhat oblique; grey, tips of scales whitish, posteriorly bronzy-tinged; a basal patch finely irrorated with white, edge on costal half rather oblique, well-defined, followed by a silvery-metallic streak from costa edged with blackish suffusion, on dorsal half suffused into ground-colour; a ferruginous-bronzy blotch on middle of costa, edged with two silvery-metallic spots anteriorly and a curved streak posteriorly, and including a silvery-metallic costal dot, all these edged with some dark fuscous suffusion; a silvery-metallic dot in disc beneath middle; some dark fuscous suffusion towards middle of dorsum; a tuft (probably erectile) of fulvous-tinged scales in disc beyond middle, followed by two or three silvery-metallic dots surrounded with blackish suffusion; a prismatic silvery-metallic submarginal somewhat interrupted streak running round posterior third of costa and termen to tornus, edged with blackish suffusion, costal edge

above this suffused with deep ferruginous: cilia dark grey, basal third irrorated with whitish and spotted with black. Hindwings rather dark bronzy-grey; cilia grey, with dark fuscous basal line.

Colombia, La Crumbre, 6600 feet, in May (*Parish*); one specimen.

Glyphipteryx cestrota, n. sp.

♂♀. 7–8 mm. Head, thorax, and abdomen dark fuscous. Palpi with appressed scales, white, second and terminal joints each with two blackish bands. Forewings elongate, costa gently arched, apex obtuse-pointed, termen sinuate, rather strongly oblique; dark fuscous, sometimes posteriorly bronzy-tinged; five slender whitish streaks from costa, anteriorly darker-edged, first from middle oblique, reaching half across wing, second rather less oblique, united at a very obtuse angle with a similar streak from dorsum before tornus, silvery-metallic in disc, last three shorter, direct; two silvery-metallic dots on lower portion of termen, one towards termen above middle, and one on subapical indentation; a black apical dot: cilia grey-whitish, basal half fuscous or whitish-fuscous limited by a blackish line indented with whitish beneath apex, with projecting blackish hook above apex. Hindwings elongate, tolerably pointed; dark grey; cilia grey.

Peru, Lima, 500 feet, in August (*Parish*); fourteen specimens. Allied to *refractella*.

Glyphipteryx syndecta, n. sp.

♂♀. 6–7 mm. Head, thorax, and abdomen bronzy-grey. Palpi with loosely appressed scales, white, second joint with two dark fuscous bands, terminal joint with dark fuscous basal band and anterior streak on apical half. Forewings elongate, rather narrow, costa gently arched, apex obtuse-pointed, termen slightly sinuate, very oblique; glossy bronzy-grey, more or less suffused with bronzy-ochreous on apical third; five white wedgeshaped streaks from costa, anteriorly margined with dark fuscous, first from beyond middle, oblique, reaching half across wing, second approximated, silvery-metallic in disc, third short, direct, fourth and fifth short, near apex, approximated; a narrow slightly curved or almost straight pointed very oblique white streak from middle of dorsum, anteriorly edged with dark fuscous, its apex almost reaching apex of first costal; a fine direct whitish dark-margined streak from dorsum before tornus, almost reaching apex of first costal; a violet-silvery-metallic dot on tornus, and a minute one on subapical indentation; two or three fine longitudinal blackish lines are sometimes perceptible in

disc towards termen; a small black apical spot: cilia grey-whitish, basal half greyer, limited by a dark fuscous line indented with whitish beneath apex, with projecting blackish hook above apex. Hindwings lanceolate, dark grey; cilia grey.

Peru, Matucana, 7780 feet, in July, twenty specimens, and also one from Chosica, 2800 feet (*Parish*).

GRACILARIADAE.

Lithocolletis oxygrapta, n. sp.

♂. 6 mm. Head, palpi, and thorax silvery-white. Abdomen white, with lateral series of dark fuscous crescentic marks. Forewings lanceolate; pale ochreous-yellowish sprinkled with dark fuscous; very acutely angulated silvery-white fasciae before and beyond middle, narrow towards costa but rather broader towards dorsum, edged posteriorly with blackish irroration, basal area up to first fascia wholly suffused with silvery-white and only separated from it by some dark scales towards costa; a white streak along lower half of termen, united at a somewhat acute angle with a slender white obscurely dark-edged streak from $\frac{3}{4}$ of costa; a small white triangular spot on costa near apex, and another at apex, edged beneath by a short fine black linear mark: cilia whitish, round apex with basal third tinged with ochreous-yellowish and limited by a blackish-grey line. Hindwings grey; cilia whitish-grey.

Peru, Lima, 500 feet, in August (*Parish*); one specimen.

Lithocolletis clerotoma, n. sp.

♀. 7 mm. Head and thorax bronzy-ochreous, face and palpi whitish. Abdomen grey. Forewings lanceolate; bronzy-fulvous-ochreous; narrow very obtusely angulated transverse silvery-white fasciae beyond $\frac{1}{4}$ and at $\frac{1}{2}$, edged posteriorly with a few black scales except towards dorsum; a similar fascia at $\frac{3}{4}$, interrupted above middle, edged posteriorly with black scales throughout; a white wedgeshaped spot on costa before apex, apex beyond this sprinkled with black: cilia pale greyish, basal third ochreous-bronzy. Hindwings rather dark grey; cilia grey.

Ecuador, Huigra, 4500 feet, in June (*Parish*); one specimen.

Lithocolletis antitoxa, n. sp.

♂. 5 mm. Head whitish (partially rubbed). Thorax bronzy-ochreous. Abdomen grey. Forewings lanceolate; bronzy-golden-

ochreous, tips of scales fuscous; two narrow hardly outwards-curved silvery-white fasciae beyond $\frac{1}{4}$ and at $\frac{1}{2}$, edged posteriorly with black, slightly nearer base on dorsum than on costa; a similar moderately inwards-curved fascia at $\frac{3}{4}$; a short inwardly-oblique white strigula from costa near apex, edged posteriorly with black: cilia light greyish, round apex and upper part of termen with basal third bronzy-golden-ochreous limited by some blackish-grey points. Hindwings and cilia grey.

PERU, Lima, 500 feet, in August (*Parish*); one specimen.

Lithocolletis iriphanes, n. sp.

♂ ♀. 6 mm. Head and thorax bronzy-orange, frontal tuft mixed with whitish. Palpi whitish. Abdomen dark grey. Forewings lanceolate; shining bronzy-orange; markings pale violet-golden, edged posteriorly with black; narrow hardly curved nearly direct transverse fasciae at $\frac{1}{3}$ and beyond middle, second often followed in disc by a spot of blackish irroration; small direct transverse wedgeshaped exactly opposite costal and terminal spots at $\frac{2}{3}$, more or less margined anteriorly also with black; a similar spot at apex extending into costal cilia: cilia pale bronzy-greyish, basal third bronzy-orange. Hindwings dark grey; cilia grey.

PERU, Lima, 500 feet, in August (*Parish*); twelve specimens. Allied to *desmodiella*, but considerably larger and less deeply coloured.

Lithocolletis epispila, n. sp.

♀. 6–7 mm. Head and palpi ochreous-whitish. Thorax ochreous. Abdomen grey. Forewings lanceolate; bronzy-ochreous, apex of scales infuscated; narrow silvery-white transverse fasciae beyond $\frac{1}{4}$ and at $\frac{1}{2}$, obtusely angulated above middle, margined posteriorly with some black scales; a similar fascia at $\frac{3}{4}$, more or less interrupted in disc; a silvery-white spot in disc beyond this, edged beneath with black; a silvery-white apical spot, edged on termen with black irroration: cilia pale greyish, with scattered black scales round apex. Hindwings dark grey; cilia grey.

ECUADOR, Huigra, 4500 feet, in June (*Parish*); two specimens. Allied to *clerotoma*.

Phrixosceles paragrapta, n. sp.

♂ ♀. 9 mm. Head ochreous-whitish, neck with some dark fuscous scales. Palpi whitish, with apical band of second joint and median band of terminal joint dark fuscous. Thorax ochreous-white,

with an irregular dark fuscous band on anterior margin. Abdomen fuscous. Forewings elongate, narrow, parallel-sided, apex shortly and obtusely pointed; pale brownish-ochreous, from base to beyond middle crossed by about eight somewhat oblique irregular blackish striae, alternate interspaces mostly suffused with white; tornal area narrowly suffused with whitish, above which are two very oblique black lines in disc and a blackish mark on costa; apical area with three direct transverse blackish lines, first somewhat irregular: cilia whitish, with basal area pale violet-ochreous limited by a blackish line, towards tornus grey. Hindwings and cilia dark grey.

British Guiana, Bartica, in December and April (*Parish*); two specimens.

Acrocercops xystrota, n. sp.

♀. 8 mm. Head whitish. Palpi long, white, second joint with scales roughened at apex beneath. Thorax pale yellow-ochreous. Abdomen grey. Forewings very narrow, parallel-sided, short-pointed; light yellow-ochreous, costal area transversely strigulated with blackish; five slender parallel somewhat oblique white fasciae edged on costal half with blackish, first at $\frac{1}{6}$, last at $\frac{5}{6}$; a narrow reversed-oblique black streak between fourth and fifth, and a black mark from fifth to apex: cilia pale ochreous, towards tornus grey. Hindwings dark grey; cilia grey.

British Guiana, Mallali, in March (*Parish*); one specimen.

Acrocercops soritis, n. sp.

♂. 7 mm. Head white. Palpi long, slender, white. Thorax white, patagia fuscous. Abdomen dark grey. Forewings very narrowly elongate-lanceolate; ochreous-fuscous; markings snow-white, black-margined; fasciae at $\frac{1}{4}$ and $\frac{1}{2}$, broad on dorsum, each narrowed almost to a point on costa; a dot on costa at $\frac{3}{4}$; an undefined dot of mixed whitish and black scales on tornus; a very fine oblique transverse line near apex; an apical dot: cilia grey, at apex with black basal and median lines, white between these. Hindwings dark grey; cilia grey.

Ecuador, Huigra, 4500 feet, in June (*Parish*); one specimen.

Acrocercops stalagmitis, n. sp.

♀. 9 mm. Head white. Palpi long, slender, white. Thorax fuscous. Abdomen grey. Forewings very narrow, short-pointed;

rather dark fuscous; markings snow-white, black-margined; a fascia towards base, very broad on dorsum, narrowed to only moderate on costa; a moderate median fascia, narrowed towards costa; a slightly oblique wedgeshaped spot from costa beyond $\frac{3}{4}$, reaching $\frac{2}{3}$ across wing; a smaller transverse wedgeshaped spot from costa near apex: cilia fuscous, at apex with black basal and median lines, whitish between these. Hindwings dark grey; cilia grey.

British Guiana, Bartica, in December (*Parish*); one specimen.

Acrocercops argocosma, n. sp.

♂. 8–9 mm. Head white. Palpi long, slender, white. Thorax fuscous, patagia white. Abdomen grey, towards base and apex light greyish-ochreous. Forewings very narrowly elongate-lanceolate; light ochreous-fuscous; markings snow-white, edged with blackish scales; a rather broad fascia at $\frac{1}{4}$, slightly broader dorsally; a broad median fascia, distinctly broader towards dorsum; an elongate spot on tornus; an oblique fascia from costa above this, narrowed almost to a point on termen; a slender rather oblique transverse line before apex; an apical dot: cilia light ochreous-grey, opposite apex with black basal and median lines. Hindwings grey; cilia light grey.

Ecuador, Huigra, 4500 feet, in June (*Parish*); three specimens.

Acrocercops nolckeniella, Zell.

British Guiana, Bartica and Mallali (*Parish*); several specimens. *A. sanctae-crucis*, Wals., from the West Indies, is only a synonym of this.

Acrocercops chrysocosma, n. sp.

♂♀. 8 mm. Head shining metallic-bronze, face whitish-tinged. Palpi very long and slender, bronzy-whitish. Thorax golden-metallic, anteriorly suffused with bronzy. Abdomen dark grey, towards apex ochreous-bronzy. Forewings extremely narrow, parallel-sided, short-pointed; orange; a golden-metallic patch extending on dorsum almost from base to near middle, above with extremities silvery and touching costa (especially anterior), top semiovally excavated between these and strongly black-edged, or with costal space wholly blackish, posterior margin slightly oblique, blackish-edged; a silvery-metallic blackish-edged spot on middle of costa; a larger subquadrate golden-metallic blackish-

edged spot on dorsum before tornus, reaching half across wing; a violet-golden-metallic blotch occupying apical fourth of wing: cilia grey. Hindwings and cilia grey.

British Guiana, Bartica and Mallali, from December to March (*Parish*); twenty-four specimens.

Acrocercops melanactis, n. sp.

♂. 8 mm. Head shining metallic-bronzy, face whitish-tinged. Palpi very long and slender, yellow-whitish. Thorax golden-bronzy-metallic. Abdomen dark grey. Forewings extremely narrow, parallel-sided, rather short-pointed; orange; costal edge black throughout; a brassy-yellow blotch extending on dorsum from base to $\frac{2}{5}$, above touching costa at extremities, semiovally excavated between these and strongly blackish-edged, posterior margin oblique and blackish-edged; an elongate blackish mark on costa before middle, containing an obscure silvery-whitish dot anteriorly; a triangular brassy-yellow blackish-edged spot on dorsum before tornus, dorsal edge blackish between this and basal blotch; a bronzy-golden blotch suffused with greyish-purple occupying apical fourth of wing, more extended dorsally: cilia dark grey. Hindwings and cilia dark grey.

British Guiana, Mallali, in March (*Parish*); one specimen.

Acrocercops trimetalla, n. sp.

♂♀. 8–9 mm. Head shining metallic-bronzy, face whitish-tinged. Palpi very long and slender, ochreous-whitish. Thorax violet-bronzy-orange. Abdomen grey, base and apex ochreous-tinged. Forewings extremely narrow, parallel-sided, moderately pointed; bright orange; a brassy-metallic blotch extending along dorsum from near base to $\frac{2}{5}$, upper edge sinuate and marked with a few blackish scales, anterior angle connected with costa by a silvery dot edged posteriorly with black, posterior angle only reaching half across wing; an elongate silvery-metallic mark on costa before middle, edged with a few blackish specks; a triangular brassy-metallic spot on dorsum before tornus, reaching half across wing; a narrow elongate golden-metallic patch extending along termen to apex: cilia grey. Hindwings rather dark grey; cilia grey.

British Guiana, Bartica, in December and January (*Parish*); two specimens.

Acrocercops encentris, n. sp.

♂ ♀. 9–10 mm. Head, palpi, and thorax shining ochreous-whitish, crown more or less tinged with bronzy-ochreous, labial palpi very long and slender, maxillary rudimentary. Abdomen whitish-ochreous. Forewings extremely narrow, moderately pointed; shining white; markings ochreous-fuscous; a narrow elongate spot along dorsum from near base to $\frac{1}{3}$ of wing; sometimes a small spot on costa at $\frac{2}{9}$; a moderate spot on costa beyond middle, sometimes divided into two, and two or three small spots on dorsum before and opposite to it, variably connected with it; two transverse marks from costa posteriorly; a moderate darker fuscous spot occupying apex: cilia greyish, on termen suffused with ochreous-whitish on basal half, on costa white. Hindwings dark grey; cilia grey.

British Guiana, Bartica, from December to February (*Parish*); seven specimens.

Acrocercops hastigera, n. sp.

♂. 8 mm. (Head and thorax damaged.) Abdomen grey. Forewings very narrow, parallel-sided, shortly and obtusely pointed; brown, along dorsal streak and on posterior half of wing suffused with fuscous, becoming orange towards apex; a strong snow-white streak along dorsum from base, terminated by a fine slightly-curved violet-silvery line crossing wing at $\frac{5}{6}$; a very oblique violet-silvery strigula from costa before $\frac{2}{3}$, nearly reaching transverse line in middle: cilia white, towards tornus greyish, round apex with base grey within a black line, with a dark grey spot on costa at extremity of this line, and a dark grey patch at apex containing two oblique projecting blackish hooks. Hindwings rather dark grey; cilia grey.

Ecuador, Duran, in June (*Parish*); one specimen. Allied to *piligera*; except for the injury to head, the example is in fine condition.

Acrocercops piligera, n. sp.

♂. 8 mm. Head pale bronzy-ochreous, crown becoming whitish posteriorly, collar white. Palpi long, slender, white, apex of second joint infuscated. Thorax ochreous-bronze, with whitish dorsal stripe. Abdomen grey. Forewings very narrow, parallel-sided, shortly and obtusely pointed; ferruginous-fuscous, dorsal third from base to tornus ferruginous; a white dorsal streak from base to middle of wing, its extremity emitting an oblique strigula; a slender irregular white streak from near beyond this along dorsum

to tornus, ending in another oblique strigula terminated by a fine transverse leaden-metallic line rising from a white costal dot; an oblique white strigula from costa beyond middle; a short black apical dash, its posterior extremity enlarged into a dot: cilia white, towards tornus grey, round apex and termen with base greyish within a black line, at apex with two projecting oblique blackish hooks. Hindwings and cilia grey.

Colombia, Cali, 500 feet, in May (*Parish*); one specimen.

Acrocercops luctuosa, n. sp.

♂. 7 mm. Head, palpi, thorax, and abdomen dark fuscous; palpi moderate, with appressed scales. Forewings very narrow, parallel-sided, shortly and obtusely pointed; dark fuscous; a fine irregular oblique white streak from middle of dorsum reaching half across wing; a minute indistinct whitish dot on costa opposite origin of this; a very fine irregular very oblique white strigula from dorsum before tornus; an indistinct transverse leaden line at $\frac{5}{6}$: cilia dark grey, at apex with two oblique projecting blackish hooks. Hindwings and cilia dark fuscous.

British Guiana, Bartica, in January (*Parish*); one specimen.

Acrocercops charitopis, n. sp.

♂ ♀. 7–8 mm. Head grey. Palpi moderate, with appressed scales, white, with more or less developed subapical band of second joint and subbasal band of terminal joint blackish. Thorax dark fuscous. Abdomen dark grey, with lateral oblique blackish and white bars. Forewings narrowly elongate-lanceolate; dark fuscous; a fine white dash along costa beyond $\frac{1}{3}$, and elongate dots before and beyond $\frac{2}{3}$; some white scales along dorsal edge, an irregular white mark from dorsum before middle, a very oblique white strigula from beyond middle of dorsum, and another longer one from tornus; an inwardly oblique white strigula from costa before apex in a line with tornal strigula; apex bronzy-tinged, apical edge finely black: cilia grey, round apex white with black subbasal line and two blackish oblique projecting hooks at apex. Hindwings dark grey; cilia grey.

British Guiana, Bartica, in February (*Parish*); three specimens.

Acrocercops caementosa, n. sp.

♀. 9–10 mm. Head and thorax whitish mixed with grey. Palpi somewhat roughened anteriorly, white, second joint blackish above towards apex, terminal joint with black median ring. Abdomen

grey, sides whitish with oblique blackish-grey marks. Middle femora with blackish apical tuft of scales beneath. Forewings very narrowly lanceolate; grey-whitish, anterior half irregularly sprinkled with dark fuscous, posterior half irrorated with dark fuscous; markings white, strongly edged anteriorly with black suffusion or irroration; an oblique wedgeshaped mark from costa before middle; an oblique triangular spot on dorsum at $\frac{2}{3}$, and two smaller ones between this and tornus; an oblique white streak from costa at $\frac{3}{4}$, almost meeting a triangular spot on tornus; an incurved transverse line near apex: cilia pale greyish-ochreous, round apex white with two lines of blackish points. Hindwings light grey; cilia pale greyish-ochreous.

PERU, Huancayo, 10,650 feet, in July (*Parish*); two specimens.

Acrocercops crotalistis, n. sp.

♂♀. 8–9 mm. Head whitish. Palpi with scales somewhat roughened anteriorly throughout, white, second joint sometimes blackish-mixed towards apex, terminal joint with blackish basal and median rings. Thorax whitish, sprinkled with fuscous. Abdomen light grey, anal tuft white. Middle femora with an expansible tuft of blackish scales beneath. Forewings narrow-lanceolate; ochreous-whitish, more or less sprinkled with dark fuscous and sometimes with ochreous, posterior half more suffusedly irrorated with dark fuscous; white oblique wedgeshaped marks, edged anteriorly with blackish irroration, from costa before middle, at $\frac{2}{3}$, and $\frac{5}{6}$, last reaching termen; similar marks from dorsum before middle and towards tornus, and a dot at tornus, sometimes connected with second costal, but all these are ill-defined and suffused posteriorly: cilia white, with three rows of blackish points, on upper part of termen with two greyish-ochreous bars, towards tornus whitish-grey. Hindwings grey; cilia whitish-grey.

PERU, Lima, 500 feet, and Chosica, 2800 feet, in July and August (*Parish*); eight specimens.

Acrocercops hapsidota, n. sp.

♂♀. 7–8 mm. Head ochreous-whitish. Palpi with scales of second joint somewhat rough at apex beneath, whitish, with subapical band of second joint and subbasal of terminal joint fuscous. Thorax ochreous-whitish sprinkled with grey. Abdomen light grey, apex ochreous-whitish. Forewings very narrow, parallel-sided, short-pointed; whitish-ochreous irrorated with grey; some white suffusion towards base of dorsum; three narrow white fasciae edged

with grey irroration, first at $\frac{1}{5}$, direct, furcate on dorsum, second before middle, rather inwards-oblique, connected with first on dorsum, third about $\frac{2}{3}$, outwards-oblique, more or less double; dorsum between second and third more or less suffused with white; a fourth outwards-oblique fascia of two lines from costa at $\frac{4}{5}$ to termen, blackish-margined anteriorly, confluent in disc with an inwards-oblique white posteriorly blackish-margined mark from costa just before apex: cilia light grey, round apex whitish with two blackish lines. Hindwings grey; cilia light grey.

British Guiana, Mallali, in March (*Parish*); six specimens.

Acrocercops obversa, n. sp.

♂. 7 mm. Head white, slightly sprinkled with grey. Palpi with scales somewhat projecting at apex of second joint beneath, white, second joint irrorated with dark fuscous except apex, terminal joint with dark fuscous median ring, and some black specks at base and beneath apex. Thorax white mixed with grey anteriorly. Abdomen whitish-grey. Forewings very narrow, parallel-sided, short-pointed; brownish, costal and dorsal edges shortly strigulated with blackish; some white suffusion above dorsum towards base; three slender white fasciae edged with blackish, first at $\frac{1}{4}$, rather outwards-oblique, second before middle, inwards-oblique, connected with first on dorsal edge and by black suffusion above this, third at $\frac{2}{3}$, outwards-oblique, partially double, connected with second on costa by thick black suffusion; a white elongate spot with some black scales on dorsum between second and third, and a dot on tornus; a fourth fascia of two fine white lines at $\frac{5}{6}$, parallel to third, connected with it on costa by strong black suffusion; a white dot on costa near apex, edged with black posteriorly; a very fine white line on upper part of termen: cilia grey, round apex with blackish basal and median lines, with a white basal dot at apex, and one beyond median line beneath apex. Hindwings and cilia grey.

British Guiana, Bartica, in April (*Parish*); one specimen. Allied to *hapsidota*.

Acrocercops fasciculata, n. sp.

♀. 8 mm. Head ochreous-whitish. Palpi with appressed scales, white, with fuscous subapical ring of second joint and subbasal ring of terminal joint. Thorax white, patagia greyish-ochreous. Abdomen grey. Forewings very narrow, parallel-sided, short-pointed; pale ochreous-yellowish suffusedly mixed with grey, towards costa suffused with dark grey; base narrowly white

sprinkled with dark grey; four transverse fasciae each made up of three appressed irregular white lines edged with dark fuscous scales, expanded dorsally and connected on or near dorsal edge, fourth just before apex, leaving a dark fuscous apical dot: cilia grey, round apex with blackish subbasal line edged with whitish. Hindwings dark grey; cilia grey.

British Guiana, Bartica, in January (*Parish*); one specimen.

Acrocercops cirrhantha, n. sp.

♂. 9 mm. Head silvery-whitish, crown yellowish. Palpi with appressed scales, white. Thorax ochreous-yellow. Basal joints of middle and posterior tarsi with bristly hairs above, but middle tibiae smooth. Forewings very narrow, parallel-sided, short-pointed; deep ochreous-yellow; from base to $\frac{2}{3}$ of wing indistinct whitish striae crossing dorsal $\frac{2}{3}$, with some blackish specks on margins of these; three elongate groups of blackish scales on posterior half of costa, two posterior containing very fine white dashes on costal edge; a fine silvery-white black-edged line along termen: cilia deep ochreous-yellow, towards tornus grey, at apex whitish above a projecting blackish line, in middle of termen with a blackish basal dot. Hindwings dark grey; cilia grey.

British Guiana, Bartica, in January (*Parish*); one specimen.

Acrocercops achnodes, n. sp.

♂ ♀. 12 mm. Head on crown light yellowish centrally suffused with dark grey, face white. Palpi white, second joint mixed with black towards apex, with rough projecting tuft beneath, terminal joint with blackish submedian and subapical rings. Thorax whitish, mixed or strigulated with dark fuscous. Abdomen pale greyish becoming ochreous-tinged towards base, with oblique lateral dark fuscous marks, anal tuft in ♂ white. Forewings extremely narrow, parallel-sided, short-pointed; basal $\frac{3}{5}$ white, with irregular transverse strigulae or broken striae of blackish irroration; apical $\frac{2}{5}$ light ochreous tinged with grey, with a few black scales, at $\frac{3}{4}$ with an acutely angulated transverse white line margined on upper half anteriorly by a thick black mark and posteriorly with black irroration; an oblique slightly curved silvery praeapical line from a white dot on costa; a black apical dot: cilia light greyish, round apex whitish with two dark grey lines (imperfect). Hindwings grey; cilia light grey.

Ecuador, Huigra, 4500 feet, in June (*Parish*); four specimens.

Acrocercops serrigera, n. sp.

♂ ♀. 10–11 mm. Head white, crown centrally somewhat mixed with grey or dark fuscous. Palpi white, second joint with long dense projecting tuft beneath, dark fuscous except apical edge, terminal joint somewhat roughened anteriorly below middle, with slender blackish submedian and subapical rings more or less developed. Thorax white, patagia grey mixed with blackish. Abdomen dark grey. Forewings very narrowly elongate-lanceolate; dark grey, more or less mixed or longitudinally streaked with black in disc; a narrow white streak along dorsum from base to tornus, its dorsal edge suffused with pale greyish, its upper edge with three irregular oblique projections, first at $\frac{1}{3}$, ground colour suffused with blackish between these, and two very oblique lines from extremity, almost reaching praeapical line; five or six very oblique blackish lines from costa reaching nearly half across wing, interspaces lighter or more or less white towards costa; a very oblique white blackish-edged line from $\frac{3}{4}$ of costa nearly to termen; a silvery-white oblique praeapical line from $\frac{4}{5}$ of costa to middle of termen; a white transverse dot or crescentic mark from costa near apex; an elongate apical mark of blackish suffusion, sometimes hardly developed: cilia grey, round apex whitish with blackish subbasal and median lines, with a black projecting apical hook. Hindwings rather dark grey; cilia grey.

Ecuador, Alausi, 9450 feet, and Huigra, 4500 feet, in June; Peru, Lima, 500 feet, in August (*Parish*); thirty-four specimens.

Acrocercops hippuris, n. sp.

♂ ♀. 13–14 mm. Head white, tinged with ochreous on crown. Palpi long, with scales of second joint somewhat roughened at apex, white, subapical ring of second joint, and subbasal and subapical rings of terminal joint more or less marked, dark fuscous. Thorax ochreous-whitish. Abdomen ochreous-whitish, more or less banded with grey posteriorly, in ♂ with very large whitish-ochreous anal tuft and long claspers. Forewings very narrow, parallel-sided, short-pointed; light brownish-ochreous or yellowish-ochreous, more or less strongly mixed or suffused with dark grey, especially in disc; from twelve to fourteen short thick rather oblique whitish streaks from costa between base and $\frac{4}{5}$, and from eight to ten nearly direct similar streaks or marks from dorsum, each reaching about $\frac{1}{3}$ across wing; an obtusely angulated transverse leaden line about $\frac{5}{6}$; a short black dash before apex, and a

white dash beneath it: cilia grey, round apex whitish with dark fuscous subbasal line, and a blackish oblique projecting hook at apex. Hindwings light grey; cilia pale grey, in ♂ tinged with ochreous.

PERU, Huancayo, 10,650 feet, and Jauja, 11,900 feet, in July (*Parish*); five specimens.

Parectopa ischnotoma, n. sp.

♀. 6 mm. Head shining pale bronzy. Palpi moderate, slender, bronzy-whitish, terminal joint with base and subapical ring dark fuscous. Thorax and abdomen dark fuscous. Forewings lanceolate; glossy dark fuscous, with faint purplish tinge; markings silvery-white; slender hardly oblique fasciae at $\frac{1}{4}$ and $\frac{1}{2}$; wedge-shaped transverse marks from costa at $\frac{3}{4}$ and near apex: cilia grey, round apex with blackish subbasal line and apical hook (imperfect). Hindwings and cilia dark fuscous.

BRITISH GUIANA, Mallali, in March (*Parish*); one specimen. Near the following species, but forewings relatively much broader, with much slenderer markings.

Parectopa isortha, n. sp.

♂. 6 mm. Head shining ochreous-white. Palpi moderate, slender, white, second joint dark fuscous towards apex, terminal joint with base and subapical ring dark fuscous. Thorax dark fuscous, apex of patagia white. Abdomen dark grey. Forewings narrowly elongate-lanceolate; dark fuscous; markings shining white; narrow direct transverse fasciae at $\frac{1}{4}$ and $\frac{1}{2}$, first somewhat broader, especially towards dorsum; moderate triangular spots on costa at $\frac{3}{4}$ and near apex; a white apical dot: cilia grey, round apex white with blackish apical hook (imperfect). Hindwings rather dark grey; cilia grey.

BRITISH GUIANA, Bartica, in February (*Parish*); one specimen.

Parectopa phaneropis, n. sp.

♀. 7 mm. Head whitish (rubbed). Palpi long, slender, white. Thorax ochreous. Abdomen grey. Forewings narrow-lanceolate; brownish-ochreous; markings snow-white, edged with a few black specks; hardly oblique fasciae at $\frac{1}{3}$ and somewhat beyond middle, narrow on costa, moderately dilated downwards; a fine rather oblique transverse line at $\frac{3}{4}$, more or less interrupted in middle; a moderate rounded-transverse spot from costa towards apex,

nearly reaching termen; a dot at apex: cilia pale ochreous-greyish, round apex whitish, with a blackish basal dot. Hindwings grey; cilia pale grey.

Ecuador, Duran, in June (*Parish*); one specimen.

Parectopa stemonodes, n. sp.

♂. 6 mm. Head whitish-bronzy. Palpi moderate, slender, white, terminal joint with base and a subapical ring blackish. Thorax dark grey sprinkled with whitish. Abdomen dark grey. Forewings elongate-lanceolate; dark violet-grey irrorated with whitish; markings white margined anteriorly with blackish; slender irregular somewhat oblique fasciae at $\frac{1}{4}$ and $\frac{1}{2}$, slightly expanded at extremities; triangular spots on costa at $\frac{3}{4}$ and towards apex, and a dot on tornus opposite first of these, apex of second produced as a crescentic strigula to termen; a dot at apex: cilia light grey, on termen sprinkled with blackish, at apex white (imperfect). Hindwings grey; cilia light grey.

Ecuador, Huigra, 4500 feet, in June (*Parish*); two specimens. A third example from same locality is in all probability the female of same species; thorax suffused with white, white markings of forewings much larger, fasciae moderate.

Parectopa refulgens, n. sp.

♀. 6 mm. Head white. Palpi moderate, slender, white, with dark fuscous lateral line. Thorax white, patagia golden-ochreous. Abdomen grey. Forewings narrow-lanceolate; shining golden; markings shining white, edged with black irroration; dorsal half with some irregular marking towards base, two adjacent oblique streaks at $\frac{1}{4}$, two others in middle, and a single one at $\frac{3}{4}$, irregularly connected on dorsum; oblique streaks from costa at $\frac{1}{3}$, middle, and $\frac{2}{3}$, confluent with these in disc to form acutely angulated fasciae; a dot on costa near apex, and a dot at apex, edged beneath by a minute black dash; some white suffusion sprinkled with black specks along termen: cilia whitish, with a black median line, towards tornus pale greyish. Hindwings light grey; cilia pale ochreous-grey.

Ecuador, Huigra, 4500 feet, in June (*Parish*); one specimen.

Parectopa lithomacha, n. sp.

♂ ♀. 7–8 mm. Head bronzy-grey. Palpi moderate, somewhat rough-scaled anteriorly, especially at apex of second and towards

middle of terminal joint, blackish, base and apex of terminal joint whitish. Thorax whitish-grey sprinkled with dark fuscous. Abdomen grey. Forewings narrow-lanceolate; grey-whitish coarsely irrorated with dark fuscous; four costal and four dorsal more or less ill-defined white spots or marks, edged with dark fuscous suffusion, first costal beyond $\frac{1}{4}$, somewhat oblique, others subtriangular, second in middle, third at $\frac{3}{4}$, fourth near apex, somewhat inwards-oblique, first dorsal rather oblique, before first costal, others subtriangular or irregularly narrow, second somewhat before second costal, third and fourth before and beyond third costal, sometimes also a dot on termen beneath or connected with fourth costal: cilia grey, towards base whitish, round apex white with two or three blackish lines. Hindwings grey; cilia light grey.

ECUADOR, Huigra, 4500 feet, in June (*Parish*); twenty-four specimens.

Parectopa heptametra, n. sp.

♂ ♀. 11–12 mm. Head grey-whitish. Palpi long, with appressed scales, white, anterior edge of terminal joint dark fuscous. Thorax whitish, patagia and a central line dark grey. Abdomen dark grey. Forewings very narrow, parallel-sided, apex rounded-obtuse; glossy dark violet-grey, mixed with blackish towards costa; an ochreous-whitish streak along dorsum from base to tornus, narrowly interrupted beyond middle, extremity of anterior portion produced into a very oblique wedgeshaped projection; an elongate ochreous-whitish spot above tornal extremity of this streak; a fine whitish line from costa beyond middle to termen above tornus; six fine oblique whitish streaks from costa between this and apex, reaching about half across wing, terminal area beneath these with indications of suffused whitish longitudinal streaks: cilia grey, above apex with two blackish lines, whitish between these. Hindwings dark grey; cilia grey.

COLOMBIA, La Crumbre, 6000 feet, in May (*Parish*); two specimens.

Parectopa trichophysa, n. sp.

♂. 10–12 mm. Head and thorax ochreous-whitish. Palpi long, second joint brownish, with tuft of long projecting hairs beneath, terminal joint whitish with two brownish rings. Abdomen blackish, base and apex pale ochreous. Forewings very narrow, parallel-sided, shortly and obtusely pointed; whitish, somewhat sprinkled with fuscous; basal $\frac{2}{3}$ with scattered groups of dark fuscous scales; three irregular curved white marks above dorsum between $\frac{1}{3}$ and

tornus, suffused on dorsum, interspaces filled with dark fuscous irroration; two very oblique curved white lines from tornus and two very oblique straight white lines from costa before and beyond $\frac{3}{4}$, spaces between these irrorated with dark fuscous, forming more or less marked dark streaks; apical area tinged with yellow-ochreous, with a black apical dot, and a small crescentic white mark on costa near before it: cilia grey-whitish, round apex white, with two grey lines. Hindwings blackish, apical third suffused with whitish; cilia pale greyish-yellowish, anterior half of costa with very long fine expansible hairs projected beneath forewings. Undersurface of forewings blackish from base to $\frac{2}{3}$.

Peru, Lima, 500 feet, in August (*Parish*); five specimens. The curious and exceptional blackish colouring of hindwings and abdomen are probably (with the expansible hairs) confined to the ♂.

Parectopa dactylota, n. sp.

♂♀. 10–12 mm. Head ochreous-whitish, somewhat sprinkled with grey. Palpi long, second joint pale ochreous somewhat sprinkled with blackish, with very long projecting tuft beneath, terminal joint rough-scaled below middle, white, with well-marked black median and subapical rings. Thorax ochreous-whitish, patagia mixed with fuscous. Abdomen grey. Forewings very narrowly lanceolate; ochreous-grey irrorated with blackish, becoming more ochreous towards apex, basal area more or less suffused with whitish-ochreous; an irregular white subdorsal streak from near base to tornus, upper edge forming three oblique rounded prominences between $\frac{1}{3}$ and tornus, interspaces filled with blackish; two very oblique curved whitish lines from tornus to near praeapical line; two pale ochreous very oblique lines from costa opposite these; an oblique slightly curved silvery praeapical line from $\frac{4}{5}$ of costa to termen; a white crescentic mark from costa just before apex; a blackish apical dot: cilia light greyish, round apex white with two dark grey lines, base ochreous. Hindwings grey; cilia pale grey.

Ecuador, Huigra, 4500 feet, in June; Peru, Lima, 500 feet, in August (*Parish*); seven specimens. Very like *Acrocercops serrigera*, to which there may be real relationship; less deeply coloured, more ochreous, without the whitish costal streaks, and differing also in colour of head and palpi.

Parectopa pselaphotis, n. sp.

♂ ♀. 7–8 mm. Head and thorax grey-whitish irrorated with dark grey, face whitish. Palpi moderately long, slender, whitish. Abdomen grey. Forewings very narrowly lanceolate; grey-whitish, closely irrorated with dark fuscous; very obscure oblique white streaks, anteriorly suffusedly margined with dark fuscous, from dorsum before middle and at $\frac{2}{3}$, reaching about half across wing, and a dot on tornus; a blackish longitudinal dash, finely edged above with white, above lower part of termen; a fine elongate black mark in apex: cilia pale greyish, round apex whitish, with two fine lines of blackish points, and a double obliquely projecting blackish apical hook. Hindwings rather dark grey; cilia light grey.

Ecuador, Huigra, 4500 feet, in June (*Parish*); four specimens. A very obscurely marked species.

Parectopa viminea, n. sp.

♂. 9 mm. Head and thorax white mixed with grey. Palpi long, blackish, second joint with rough projecting hairs towards apex beneath, terminal joint white with black median ring. Abdomen grey. Forewings very narrow, parallel-sided, moderately and acutely pointed; dark grey mixed with black; about eleven very oblique irregular fine white streaks from costa, and about ten, anteriorly broader and confluent, from dorsum, suffusedly meeting in disc; an elongate apical dot of black irroration: cilia grey-whitish, round apex white with two or three lines of blackish points. Hindwings grey; cilia pale grey.

Peru, Matucana, 7780 feet, in July (*Parish*); one specimen.

Gracilaria callichora, n. sp.

♂ ♀. 8–10 mm. Head prismatic violet-fuscous, face silvery-white. Palpi slender, whitish, second joint irrorated with grey, with apex dark grey, apex of terminal joint blackish. Thorax brassy-yellow, shoulders prismatic-fuscous. Abdomen dark grey, beneath pale yellowish. Middle legs white, femora and tibiae blackish, tarsal joints with apical black dots; posterior legs whitish-yellowish, basal half and apex of tibiae grey, femora white with apical half blackish. Forewings narrowly elongate-lanceolate; shining brassy-yellow; a patch of grey suffusion along basal third of costa; a violet-grey patch strigulated with dark violet-fuscous along termen: cilia grey mixed with darker. Hindwings rather dark grey; cilia grey.

British Guiana, Bartica, in February (*Parish*); three specimens.

Gracilaria immuricata, n. sp.

♂. 10 mm. Head pale ochreous mixed with violet-grey, face prismatic ochreous-whitish. Palpi loosely scaled, ochreous-whitish, second joint somewhat sprinkled with dark fuscous, terminal joint with dark fuscous subapical ring. Thorax light brownish-ochreous. Abdomen light greyish. Middle femora and tibiae dark fuscous, tarsi whitish; posterior legs ochreous-whitish. Forewings very narrowly elongate-lanceolate; fulvous-ochreous irrorated with deep purple; a broad pale ochreous-yellowish streak occupying costal third of wing from base to $\frac{2}{3}$, costal edge with some scattered black dots and specks, a spot of blackish suffusion beneath its lower edge before middle of wing, preceded by a slight suffusion of the pale colour of streak into ground colour: cilia pale greyish, suffused with brownish-ochreous round apex and sprinkled with darker. Hindwings light grey; cilia pale ochreous-greyish.

Peru, Lima, 500 feet, in August (*Parish*); one specimen. I have also a worn example from Ecuador, Huigra, 4500 feet, which is probably the same species.

Gracilaria eolampis, n. sp.

♂ ♀. 12–13 mm. Head reddish-ochreous, face shining whitish-ochreous. Palpi ochreous-whitish tinged or sprinkled with reddish, terminal joint slightly roughened anteriorly, with dark fuscous subapical ring. Thorax violet-reddish-ochreous. Abdomen dark grey. Middle femora and tibiae reddish-brown, tibiae beneath with long roughly projecting scales, tarsi white; posterior legs whitish-ochreous, tibiae and basal joint of tarsi suffused with dark grey above. Forewings very narrowly lanceolate; violet-reddish-ochreous, faintly strigulated with darker; an undefined light yellowish suffusion along costa from about $\frac{1}{6}$ to $\frac{5}{8}$, occupying about $\frac{1}{3}$ of wing, with scattered strigulae of ground colour along costa: cilia reddish-ochreous, towards tornal area grey. Hindwings dark grey, thinly scaled in disc towards base; cilia grey.

British Guiana, Bartica, from December to February (*Parish*); ten specimens.

Gracilaria chloroptila, n. sp.

♂. 13 mm. Head ochreous-grey-whitish, crown violet-iridescent. Palpi slightly roughened anteriorly, whitish, second joint grey anteriorly towards apex, terminal joint with blackish anterior

streak towards base, and indistinct grey subbasal and subapical rings. Thorax violet-brownish-ochreous. Abdomen dark grey, with two long expansible ochreous-whitish anal hair pencils. Middle femora and tibiae dark fuscous, both tufted with rough blackish scales, apex of tibiae blackish, tarsi white; posterior legs grey-whitish. Forewings very narrowly elongate-lanceolate; light brownish, with strong violet reflections, strewn throughout with fine fuscous strigulae, costa narrowly whitish-tinged; apex whitish-tinged, with two or three darker fuscous strigulae: cilia grey, round apex whitish, with some rows of dark grey points. Hindwings dark grey, thinly scaled in disc anteriorly; cilia grey.

British Guiana, Bartica, in February (*Parish*); one specimen.

Gracilaria oriarcha, n. sp.

♂. 19 mm. Head grey-whitish. Palpi slightly roughened anteriorly, whitish, sprinkled with grey. Thorax grey-whitish suffused with light reddish-fuscous. Abdomen pale greyish, anal tuft whitish-ochreous. Middle legs rather dark reddish-fuscous, tibiae tufted towards apex above, tarsi whitish; posterior legs whitish obscurely banded with grey irroration. Forewings very narrow, parallel-sided, moderately pointed; violet-reddish-fuscous, somewhat sprinkled with dark fuscous, strewn with irregular dots of whitish scales, edges blackish minutely dotted with white: cilia ochreous-whitish, on costa and round apex with several groups of blackish specks, towards tornus pale greyish. Hindwings grey; cilia light grey.

Peru, Jauja, 11,900 feet, in July (*Parish*); one specimen. This interesting insect is much the largest of the whole family known to me.

LYONETIADAE.

Opostega microlepta, n. sp.

♂♀. 4 mm. Head, antennae, thorax, and abdomen ochreous-white. Forewings lanceolate; shining ochreous-white; a minute black apical dot: cilia ochreous-whitish, more ochreous-tinged towards base, with a faint grey line at base of costal cilia, and two others beyond it converging to apical dot. Hindwings pale greyish-ochreous; cilia whitish-ochreous.

British Guiana, Bartica, in February; Ecuador, Duran, in June (*Parish*); two specimens. Distinguished by its minute size.

Opostega acidata, n. sp.

♂. 8–9 mm. Head, antennae, and thorax ochreous-whitish. Abdomen grey-whitish. Forewings lanceolate; shining ochreous-whitish; a minute black apical speck: cilia ochreous-whitish. Hindwings and cilia pale grey.

Ecuador, Huigra, 4500 feet, in June (*Parish*); two specimens.

Opostega sacculata, n. sp.

♂. 6 mm. Head and thorax white. Antennae whitish-ochreous, eyecaps white. Abdomen ochreous-whitish. Forewings lanceolate; shining white, with faint yellowish tinge; a subtriangular dark grey spot on costa slightly beyond middle, apex obtuse, reaching half across wing; a small praeapical spot of yellowish-grey suffusion; a minute black apical dot: cilia whitish, costal cilia with three fine oblique blackish-grey lines, second terminating in apical dot, and two or three blackish scales at base beneath apex. Hindwings grey; cilia light grey.

Ecuador, Huigra, 4500 feet, in June (*Parish*); one specimen.

Opostega paromias, n. sp.

♀. 8 mm. Head and thorax white. Antennae dark grey, eyecaps white. Abdomen ochreous-whitish. Forewings lanceolate; shining whitish, dorsal half faintly greyish-tinged; a suffused dark fuscous very oblique strigula from costa towards base; a semioval dark fuscous blotch along median portion of costa, not reaching half across wing; a small undefined dark grey praeapical spot, apex beyond this grey; a small black apical dot: cilia grey, on costa with two fine dark grey oblique lines, second running to near apical dot, and a third beyond apex of wing. Hindwings and cilia grey.

Peru, Matucana, 7780 feet, in July (*Parish*); one specimen. Allied to the preceding.

Opostega pontifex, n. sp.

♂. 7 mm. Head and thorax white. Antennae grey, eyecaps white. Forewings lanceolate; shining white; extreme costal edge dark fuscous from base to fascia; a narrow irregular inwardly oblique dark fuscous median fascia, whence a blotch of fuscous suffusion extends along dorsum to tornus: cilia fuscous, costal cilia with a strong dark fuscous basal streak. Hindwings and cilia grey.

Colombia, Cali, 500 feet, in May (*Parish*); one specimen.

ENTEUCHA, n. g.

Head rough-haired; tongue absent. Antennae $\frac{3}{5}$, in ♂ simple, basal joint forming a very large oblong eyecap, much longer than eye. Labial palpi moderate, thickened with scales, drooping and appressed between legs, second joint with scales somewhat projecting laterally, terminal joint rather longer than second, tolerably obtuse. Maxillary palpi obsolete. Posterior tibiae shortly rough-scaled above. Forewings with apex somewhat upturned, cell well-marked, long, its margins coincident towards base, 2 from angle, type of neuration apparently as in *Opogona* but with some veins absent, not made out. Hindwings $\frac{1}{3}$, linear-lanceolate, cilia 4; neuration not determined.

A very interesting genus, intermediate in character between *Opogona* and *Opostega*; the fusion of cell-margins towards base probably explains the process of formation of the simple median vein of *Opostega*, in which the fusion is complete.

Enteucha cyanochlora, n. sp.

♂. 6 mm. Head, palpi, and antennae light yellow-ochreous, collar and thorax deep indigo-blue. Abdomen dark grey. Forewings broad-lanceolate; deep indigo-blue; a small oblique-triangular pale ochreous spot on costa beyond middle; a round pale yellow-ochreous blotch occupying apex and terminal cilia, rest of cilia deep indigo-blue. Hindwings dark purple-grey; cilia dark grey.

BRITISH GUIANA, Bartica, in February (*Parish*); one specimen.

Phyllocnistis dorcas, n. sp.

♀. 5 mm. Head, palpi, antennae, thorax, and abdomen silvery-white. Forewings narrow-lanceolate, apex caudate; silvery-white; apical fourth suffused with light yellow; a short very fine oblique grey strigula from costa beyond middle; two opposite transverse fine grey strigulae at $\frac{2}{3}$, not meeting; a large round black apical dot in cilia, nearly preceded by a fine transverse dark grey strigula: cilia white, on termen with basal $\frac{2}{3}$ light yellow limited by a faint grey line, on costa with a short fine oblique grey strigula preceding the praeapical one. Hindwings and cilia white.

BRITISH GUIANA, Mallali, in March (*Parish*); one specimen.

Phyllocnistis sciophanta, n. sp.

♂. 5 mm. Head, palpi, thorax, and abdomen white. Forewings narrow-lanceolate, caudate; shining white; oblique grey strigulae

from costa at ½ and ⅔, and two from dorsum towards tornus, spaces between these very faintly yellowish-tinged, indicating an acutely angulated fascia; a small very faintly yellowish-tinged spot on costa at ¾, edged faintly posteriorly with grey; apex slightly tinged with yellowish; a minute black apical dot: cilia white, with three fine indistinct grey bars on costa, and two (or three?) projecting at apex. Hindwings and cilia whitish.

Peru, Lima, 500 feet, in August (*Parish*); one specimen.

Phyllocnistis sexangula, n. sp.

♀. 8–10 mm. Head, palpi, thorax, and abdomen white. Forewings narrow-lanceolate, apex caudate; shining white; markings light brassy-yellowish, edged with rather dark fuscous; a narrow median longitudinal streak from base to beyond middle, where it unites at an acute angle with a narrow oblique bar from middle of costa; in one specimen an oblique dark fuscous bar connecting this longitudinal streak with dorsum before middle of wing, in the other reduced to a small projection on its lower margin; a narrow angulated transverse fascia at ⅔, and a transverse bar from costa at ⅞, all these markings connected by a line of fuscous suffusion in disc; a praeapical spot containing a black dot; a round apical black dot: cilia white, on costa with three fine dark fuscous bars, at apex with four fine diverging dark fuscous bars, on termen with basal half light greyish-ochreous limited by a fine dark fuscous line, on tornus with a projection of dark fuscous scales. Hindwings grey-whitish or pale grey; cilia whitish.

Peru, Matucana, 7780 feet, in July (*Parish*); two specimens. The largest species of the genus.

Phyllocnistis rotans, n. sp.

♂ ♀. 5–6 mm. Head and thorax whitish-yellowish, with leaden-silvery reflections. Palpi whitish. Abdomen grey. Forewings narrow-lanceolate, apex caudate; violet-whitish, dorsal half violet-grey; markings golden-yellow edged with dark fuscous; a median longitudinal streak from base to middle; a narrow slightly curved oblique fascia beyond middle; a somewhat oblique bar from costa at ⅔, reaching half across wing; a transverse spot before apex; a black apical dot: cilia grey, on costa with whitish reflection and three blackish bars, at apex with three diverging blackish bars, on termen with blackish median shade. Hindwings dark grey; cilia grey.

Ecuador, Alausi, 9450 feet, in June (*Parish*); five specimens. Allied to the North American *insignis*.

Lyonetia zapyropis, n. sp.

♂. 8 mm. Head, palpi, and thorax shining white. Antennae grey, basal joint white. Abdomen whitish. Forewings narrow-lanceolate; shining white; an oval deep orange blotch occupying wing from middle to $\frac{4}{5}$, anteriorly edged with grey suffusion; apical area beyond this grey, with a black praeapical spot bilobed posteriorly: cilia grey, on costa with three short blackish bars, at apex with two blackish projecting bars and a whitish ray between them, on termen with some black scales at base. Hindwings and cilia grey.

British Guiana, Mallali, in March (*Parish*); one specimen. Appears to mimic *Thiotricha argoxantha.*

Lyonetia acrodora, n. sp.

♂. 7 mm. Head, palpi, and thorax shining white, face pale greyish-ochreous. Antennae whitish. Abdomen grey, sides whitish. Forewings narrow-lanceolate; shining white; two oblique light ochreous-yellowish bars edged with dark fuscous from middle of costa and beyond, running into a light ochreous-yellowish streak edged posteriorly with dark fuscous crossing wing obliquely inwards from costa at $\frac{2}{3}$; a deep orange blotch occupying apical fourth of wing, anterior edge nearly straight, edged with dark fuscous; a black apical dot: cilia grey, at apex with three projecting blackish hooks. Hindwings and cilia dark grey.

British Guiana, Bartica, in February (*Parish*); one specimen.

Lyonetia firmata, n. sp.

♂. 7·5 mm. Head, palpi, and thorax white. Abdomen whitish. Forewings very narrow, parallel-sided, apex acute; shining white; a slender oblique dark fuscous streak from costa at $\frac{2}{3}$ and a shorter one beyond it, both nearly or quite touching corresponding dark grey dots on termen; apex of wing pale ochreous-yellowish, with a black apical dot: cilia grey, on costa white with three dark fuscous bars, at apex with three diverging blackish bars, beneath apex with base light ochreous-yellowish, limited by a short blackish line edged externally with white. Hindwings and cilia dark grey.

Peru, Lima, 500 feet, in August (*Parish*); one specimen.

Lyonetia vallaris, n. sp.

♂ ♀. 5–6 mm. Head, palpi, antennae, thorax, and abdomen shining whitish. Forewings narrow-lanceolate, acute; shining

whitish; a slender transverse fulvous-ochreous fascia at $\frac{3}{4}$; a transverse black apical dot: cilia whitish, opposite apex with two blackish lines. Hindwings grey-whitish; cilia whitish.

British Guiana, Bartica, in February and March (*Parish*); twenty specimens.

Erioptris, n. g.

Head smooth, posterior part of crown shortly rough-haired, face retreating; tongue short. Antennae $\frac{5}{6}$, in ♂ stout, serrulate, basal joint very long, dilated and concave beneath, forming a large eyecap further enlarged with long rough projecting scales on margins and with a tuft of hairs at extremity. Labial palpi short, drooping, filiform. Maxillary palpi absent. Posterior tibiae with some bristly hairs above. Forewings with apex down-turned; 2 from angle, 3 absent, 7 to costa, 8 absent, 11 from beyond middle. Hindwings $\frac{1}{2}$, linear-lanceolate, cilia 4; transverse vein absent between 3 and 5, 4 absent, 5–7 approximated towards base.

Type *harmodia*. An interesting earlier form allied to *Lyonetia*.

Erioptris hierodora, n. sp.

♀. 8 mm. Head, palpi, and thorax silvery-white. Abdomen dark grey, ventrally banded with white. Forewings lanceolate; shining white; markings brownish-ochreous sprinkled with blackish specks; a moderate somewhat oblique antemedian fascia, rather narrowed towards dorsum; two costal blotches between this and apex, reaching about half across wing, first narrowed downwards, second rounded: cilia white, round apex suffused with ochreous, with some black specks. Hindwings dark grey; cilia grey.

British Guiana, Bartica, in February (*Parish*); one specimen.

Erioptris harmodia, n. sp.

♂. 8 mm. Head, palpi, thorax, and abdomen shining white. Antennae grey, eyecap white. Forewings narrow-lanceolate; shining white; apical $\frac{2}{3}$ light yellow-ochreous sprinkled with dark fuscous, except a slender irregular white transverse streak at $\frac{3}{4}$, the dark irroration more conspicuous beyond this but ceasing towards apex: cilia light ochreous, with short transverse dark fuscous bars near before apex on each margin. Hindwings white; cilia white, round apex suffused with grey.

British Guiana, Mallali, in March (*Parish*); one specimen.

Otoptris, n. g.

Head smooth on face and crown, roughly tufted on forehead between antennae, face retreating; tongue short. Antennae $\frac{1}{5}$, in ♂ simple, slender, basal joint very long, dilated and concave beneath, forming a large eyecap with long rough projecting scales on margins and with a tuft of hairs at extremity. Labial palpi short, drooping, filiform. Maxillary palpi moderate, slender, filiform, three-jointed. Posterior tibiae with long rough hairscales above. Forewings with apex downturned; 2 from angle, 3 absent, 6 and 7 stalked, 7 to costa, 8 absent, 11 from beyond middle. Hindwings $\frac{1}{2}$, linear-lanceolate, cilia 4; transverse vein absent between 3 and 5, 4 absent, 5–7 approximated towards base.

Type *lioxantha*. The exact similarity of the peculiar eyecap associates this genus nearly with the preceding, and the two together thus form a transitional connection between *Lyonetia* and *Tischeria*, confirming the position of the latter genus in this family.

Otoptris omphacina, n. sp.

♀. 6 mm. Head, palpi, and antennae whitish. Thorax pale yellow-ochreous. Abdomen grey-whitish. Forewings narrow-lanceolate; light ochreous-yellowish; a transverse dark fuscous dot at apex: cilia yellow-whitish, more yellowish towards base. Hindwings pale grey; cilia grey-whitish.

British Guiana, Mallali, in March (*Parish*); one specimen.

Otoptris lioxantha, n. sp.

♂ ♀. 5–6 mm. Head, palpi, and antennae white, crown and eyecaps ochreous-yellowish. Thorax ochreous-yellow. Abdomen whitish-yellowish. Forewings narrow-lanceolate; deep ochreous-yellow: cilia ochreous-whitish. Hindwings grey-whitish; cilia ochreous-whitish.

British Guiana, Bartica, in February (*Parish*); three specimens.

Otoptris penetralis, n. sp.

♀. 7 mm. Head, palpi, and antennae whitish. Thorax ochreous-yellow. Abdomen dark fuscous. Forewings narrow-lanceolate; yellow-ochreous, apex sometimes mixed with grey; a dark grey

apical dot: cilia ochreous-whitish, suffused with yellow-ochreous towards base. Hindwings dark grey; cilia whitish-grey.

British Guiana, Bartica, in February (*Parish*); two specimens.

Otoptris pissantha, n. sp.

♀. 6–7 mm. Head, palpi, and antennae whitish, crown and eye-caps sometimes greyish-tinged. Thorax purplish-fuscous. Abdomen dark grey. Forewings narrow-lanceolate; purplish-fuscous: cilia grey. Hindwings and cilia grey.

British Guiana, Bartica, in February (*Parish*); two specimens.

Tischeria ephaptis, n. sp.

♂ ♀. 8 mm. Head, palpi, and thorax ochreous-whitish. Forewings lanceolate; light ochreous-yellow; costa on anterior half slenderly grey, on posterior half rather broadly irrorated with dark grey and blackish; oblique streaks of blackish irroration from costa at ⅓ and beyond middle, reaching about half across wing; some slight grey irroration towards dorsum posteriorly, and a dot of black irroration above tornus: cilia pale greyish, opposite apex towards base pale yellowish sprinkled with blackish. Hindwings and cilia pale grey.

Peru, Chosica, 2800 feet, in July (*Parish*); four specimens.

Tischeria deliquescens, n. sp.

♂ ♀. 6–8 mm. Head and thorax pale ochreous-yellowish, somewhat sprinkled with dark grey specks. Palpi ochreous-whitish. Abdomen whitish-ochreous suffusedly irrorated with dark grey. Forewings lanceolate; light yellow-ochreous, more or less sprinkled with fuscous and dark fuscous specks, more strongly irrorated towards costa on posterior half: cilia greyish, towards base pale ochreous sprinkled with black. Hindwings and cilia grey.

British Guiana, Bartica, in February (*Parish*); seven specimens.

Tischeria plagifera, n. sp.

♂ ♀. 8–9 mm. Head, palpi, and thorax whitish slightly sprinkled with grey. Abdomen light grey. Forewings lanceolate; yellow-grey-whitish irrorated with dark grey, more or less suffused irregularly with ochreous-yellowish; a very oblique streak of blackish irroration from costa at ¼, reaching half across wing, and two less marked similar streaks of dark grey irroration beyond it, sometimes

also mixed with black; a small spot of blackish irroration beneath fold at $\frac{1}{4}$, one near dorsum beyond middle of wing, one in disc at $\frac{2}{3}$, forming extremity of third costal streak, and a dot above tornus; costal area posteriorly suffused with dark grey irroration, with a few black scales: cilia light grey, towards base tinged with yellowish and sprinkled with some black specks. Hindwings grey; cilia light grey.

Ecuador, Huigra, 4500 feet, in June (*Parish*); ten specimens.

Tischeria capnota, n. sp.

♂. 6–7 mm. Head, thorax, and abdomen slaty-grey. Palpi whitish. Forewings lanceolate, apex produced, acute; violet-grey, irregularly irrorated with blackish-grey, sometimes faintly yellowish-tinged in disc posteriorly: cilia grey, sprinkled with blackish towards base. Hindwings dark grey; cilia grey.

Peru, Lima, 500 feet, in August (*Parish*); four specimens.

Bedellia minor, Busck.

Peru, Lima, 500 feet, in August (*Parish*); several specimens.

Bedellia somnulentella, Zell.

Peru, Oroya, 12,200 feet, in July, and Lima, 500 feet, in August (*Parish*), common; a remarkable range of elevation.

Bucculatrix cirrhographa, n. sp.

♂ ♀. 6–7 mm. Head and eyecaps yellow-whitish, frontal tuft ochreous-yellowish. Thorax rather dark fuscous, posterior margin light yellowish. Abdomen dark grey. Forewings lanceolate; rather dark fuscous; markings ochreous-yellow; a spot on base of costa, connected by a slender longitudinal median streak with next fascia; an irregular transverse fascia at $\frac{1}{3}$, furcate towards dorsum, followed on costa by a spot connected with it in disc by a slender longitudinal streak extended to apex of posterior blotch, and edged beneath this by a blackish subdorsal tuft of scales; a transverse blotch on costa at $\frac{3}{4}$; three small marginal spots towards tornus, and a longitudinal subdorsal dash running into second; a small apical spot: cilia pale fuscous, on tornus mixed with pale yellowish, at apex with a dark fuscous pencil. Hindwings dark grey; cilia grey.

Ecuador, Huigra, 4500 feet, in June; Peru, Lima, 500 feet, and Chosica, 2800 feet, in July and August (*Parish*); forty-four specimens.

Bucculatrix mellita, n. sp.

♂♀. 5–6 mm. Head ochreous-white, frontal tuft sometimes mixed with yellow-ochreous. Thorax yellow-ochreous. Abdomen grey. Posterior tarsi with a black subapical dot. Forewings lanceolate, apex somewhat produced; deep yellow-ochreous; costa slenderly blackish from base to first streak; oblique white wedgeshaped streaks from costa before middle and at $\frac{2}{3}$, reaching half across wing, separated by a patch of black irroration; a subdorsal spot (probably tuft) of black irroration beneath first costal streak: cilia whitish, round apex and upper part of termen with basal half ochreous sprinkled with black and limited by a sinuate black line. Hindwings dark grey; cilia grey.

Peru, Chosica, 2800 feet, in July (*Parish*); four specimens.

Bucculatrix saccharata, n. sp.

♂. 6 mm. Head, eyecaps, and thorax white, frontal tuft centrally faintly tinged with yellowish. Abdomen ochreous-whitish. Forewings lanceolate, apex slenderly produced; white, sprinkled except towards base with minute black specks suffused with yellow-ochreous; a yellow-ochreous streak along fold from base to middle; oblique yellow-ochreous streaks sprinkled with some black specks from costa before and beyond middle and at $\frac{3}{4}$, reaching half across wing; a semioval yellow-ochreous blotch on dorsum towards tornus, edged anteriorly by a small black subdorsal tuft: cilia ochreous-whitish, round apex and on upper part of termen with basal half ochreous-yellowish, with two lines of black specks. Hindwings light grey; cilia ochreous-whitish.

Colombia, Caldas, 4400 feet, in May (*Parish*); one specimen.

Bucculatrix criticopa, n. sp.

♂. 6 mm. Head, eyecaps, and thorax white, frontal tuft centrally tinged with brownish-ochreous. Abdomen grey-whitish. Forewings lanceolate, apex rather produced; ochreous-white, sprinkled except towards base with minute black specks suffused with pale yellow-ochreous; a short oblique wedgeshaped yellow-ochreous spot on costa before middle, and a longer one at $\frac{2}{3}$ reaching half across wing, whence a slenderer line runs to middle of termen, bearing on its upper edge a minute black dot surmounted by a fine white dash; a conspicuous black tuft above middle of dorsum, posteriorly suffused with yellow-ochreous: cilia ochreous-whitish, round apex with two

lines of black specks. Hindwings light greyish; cilia ochreous-whitish.

British Guiana, Georgetown, in April (*Parish*); one specimen.

Bucculatrix increpata, n. sp.

♂ ♀. 6–7 mm. Head and eyecaps ochreous-whitish, frontal tuft sometimes centrally suffused with grey, antennae grey-whitish ringed with dark fuscous. Thorax fuscous. Abdomen dark grey. Forewings lanceolate; whitish-grey, more or less densely and suffusedly irrorated with dark fuscous; suffused oblique dark fuscous blotches from costa before and beyond middle, space between these sometimes white; a subdorsal blackish tuft between these; a suffused ochreous apical blotch, more or less irrorated with dark fuscous: cilia grey, at apex and on costa whitish, with two well-marked black lines approximated at apex and diverging upwards in costal cilia. Hindwings dark grey; cilia grey.

Ecuador, Huigra, 4500 feet, in June; Peru, Lima, 500 feet, and Chosica, 2800 feet, in July and August (*Parish*); twenty-four specimens. Varies in intensity of suffusion.

Bucculatrix instigata, n. sp.

♂ ♀. 7–8 mm. Head and eyecaps white, frontal tuft somewhat mixed centrally with fuscous. Thorax whitish sprinkled with dark fuscous. Abdomen whitish. Forewings lanceolate, apex somewhat produced; white or whitish, slightly and irregularly speckled with dark fuscous; a streak of dark fuscous suffusion along fold from base to beyond middle; thick oblique streaks of dark fuscous suffusion from costa before and beyond middle, and a more oblique one above dorsum between these, disc between these sometimes slightly tinged with yellowish; a more or less developed longitudinal apical streak of dark fuscous suffusion; all these markings variable in development and sometimes partially connected with blackish irroration: cilia whitish, round apex and towards termen with black specks, and two short black lines opposite apex. Hindwings light grey; cilia whitish.

Peru, Lima, 500 feet, and Chosica, 2800 feet, in July and August (*Parish*); twenty-two specimens.

Bucculatrix nebulosa, n. sp.

♂ ♀. 8–9 mm. Head and eyecaps whitish, frontal tuft somewhat mixed with grey. Thorax whitish speckled with fuscous. Abdomen

whitish. Forewings lanceolate, apex rather produced; whitish or ochreous-white, variably speckled with minute dark fuscous specks suffused with pale ochreous, tending to form undefined blotches on costa before and beyond middle, on dorsum between these, and at apex, but these are often faint or nearly obsolete: cilia ochreous white, round apex with some black specks. Hindwings light grey; cilia ochreous-grey-whitish.

Peru, Lima, 500 feet, in August (*Parish*); fourteen specimens.

Bucculatrix hypsiphila, n. sp.

♂. 7 mm. Head whitish, central hairs of frontal tuft blackish-grey. Antennae blackish-grey, eyecaps whitish. Thorax and abdomen grey. Forewings lanceolate, apex very slenderly and acutely caudate; ochreous-yellow; a narrow dark grey streak sprinkled with blackish along costa throughout; a grey streak sprinkled with blackish along dorsum from near base to beyond tornus, widest opposite tornus: cilia grey-whitish, round apex sprinkled with black. Hindwings and cilia pale grey.

Peru, Oroya, 12,200 feet, in July (*Parish*); one specimen.

Bucculatrix tanymorpha, n. sp.

♀. 10 mm. Head ochreous-whitish sprinkled with light grey, frontal tuft whitish centrally suffused with dark fuscous. Thorax greyish-ochreous sprinkled with grey. Forewings narrow-lanceolate, apex somewhat produced; greyish-ochreous sprinkled with grey; two indistinct short slender very oblique streaks of dark fuscous irroration from costa before and beyond middle, hardly reaching $\frac{1}{3}$ across wing; a subdorsal tuft of scales irrorated with blackish between these; a dot of blackish irroration in disc beyond $\frac{3}{4}$, whence a row of a few blackish specks runs to apex: cilia light greyish, on costa and round apex ochreous-whitish, towards base with some dark fuscous specks, opposite apex with two very short black lines. Hindwings and cilia grey.

Peru, Huancayo, 10,650 feet, in July (*Parish*); one specimen. A large species, but with unusually narrow forewings. On each side of base of tongue is a very minute and slender filament, no larger than a single scale, which appears to be a rudiment of the labial palpus.

Philomone euryarga, n. sp.

♀. 6 mm. Head, antennae, and eyecaps yellow-ochreous. Thorax snow-white, posteriorly ochreous-yellowish. Abdomen pale ochre-

ous. Forewings lanceolate, apex slenderly produced; ferruginous-orange; a broad snow-white longitudinal streak from base to apex, reaching nearly to costa throughout, lower margin twice sinuate and edged with scattered black scales; a short oblique white wedgeshaped strigula from dorsum before middle, edged above with some black scales: cilia pale ochreous, near base with a row of black specks, at apex with a ferruginous-orange projection. Hindwings grey; cilia light grey.

British Guiana, Bartica, in February (*Parish*); one specimen.

Philomone rivifera, n. sp.

♂ ♀. 6–7 mm. Head whitish, frontal tuft ochreous-yellow. Antennae whitish-yellowish, eyecaps whitish. Thorax ochreous-yellow, posterior extremity whitish. Abdomen greyish. Forewings lanceolate, apex slenderly produced; ferruginous-orange; a moderate silvery-white longitudinal streak, edged beneath with scattered black scales, from base above middle to termen above tornus, its posterior half curved upwards; a slender white streak edged posteriorly with some black scales obliquely outwards from before middle of dorsum to middle of this streak; very oblique wedgeshaped marks of blackish irroration on costa before middle and towards apex: cilia whitish-ochreous, with a ferruginous-orange projection at apex, two short oblique blackish hooks below apex, and several lines of blackish specks in terminal cilia and one or two in costal. Hindwings pale grey; cilia pale whitish-ochreous.

British Guiana, Bartica, from December to February (*Parish*); eight specimens.

Opogona praestans, Wals.

British Guiana, Bartica and Mallali (*Parish*), common. The genus *Dendroneura*, Wals., founded on this species, is merely a synonym of *Opogona*.

Opogona lotoxantha, n. sp.

♀. 8 mm. Head and thorax deep ochreous-yellow. Palpi, antennae, and abdomen lighter ochreous-yellowish. Forewings broad-lanceolate, apex slenderly caudate; deep ochreous-yellow: cilia lighter ochreous-yellowish. Hindwings light grey, tinged with yellowish towards apex; cilia whitish-ochreous.

British Guiana, Bartica, in February (*Parish*); one specimen. Allied to preceding.

Opogona leptynta, n. sp.

♀. 12 mm. Head and thorax shining pale yellow-ochreous. Palpi, antennae, and abdomen whitish-ochreous. Forewings broad-lanceolate, apex slender, caudate, upturned; light yellow-ochreous, deeper along fold and towards apex; a small dark fuscous spot on dorsum at $\frac{1}{3}$; a very oblique cloudy fuscous dash above tornus; an extremely fine straight fuscous line from $\frac{2}{3}$ of costa to base of apical projection; a blackish praeapical dot: cilia pale ochreous. Hindwings brassy-grey, apex ochreous-tinged; cilia pale greyish-ochreous.

British Guiana, Mallali, in March (*Parish*); one specimen.

Opogona hemidryas, n. sp.

♀. 11–12 mm. Head and thorax pale brownish-ochreous, face, fillet, antennae, and palpi ochreous-whitish. Abdomen greyish-bronze. Forewings rather broad-lanceolate, apex produced, acute; brownish-ochreous; dorsal third or half of wing more or less wholly suffused with dark brown, upper portion of this sometimes forming a darker median streak throughout; a slender suffused fuscous supramedian longitudinal line more or less developed; some dark fuscous suffusion along apical fourth of costa: cilia pale ochreous-grey, towards base pale ochreous, with a dark brownish subbasal shade round costa and upper part of termen. Hindwings bronzy-grey; cilia grey.

British Guiana, Bartica, in December and January (*Parish*); Peru, Pacaya, in June (*Mounsey*); three specimens.

Syncrobyla, n. g.

Head with appressed scales, face retreating, forehead with a raised fillet, with frontal projecting tufts from just before and behind this; tongue short. Antennae nearly 1, in ♂ simple, basal joint very long, rather stout, without pecten. Labial palpi moderate, slender, subascending, second joint with two or three projecting lateral bristles at apex, terminal joint nearly as long as second, obtuse-pointed. Maxillary palpi several-jointed, slender. Posterior tibiae with appressed hairs. Forewings with apex downturned; 2 from angle, 3 absent, 4 from near 7, 5 and 6 out of 7, 7 to costa, 8 out of 7, 9 from near 7, 11 absent. Hindwings $\frac{3}{4}$, narrow-lanceolate, cilia 3; 4 absent, cell open between 3 and 5, 5–7 approximated at base.

Related to *Opogona* and *Oinophila*.

Syncrobyla carphota, n. sp.

♂ ♀. 7–8 mm. Head and thorax light greyish-ochreous. Palpi ochreous-whitish. Abdomen light greyish. Forewings lanceolate, apex somewhat produced; light greyish-ochreous, with scattered dark fuscous scales; costal edge sometimes suffused with dark fuscous irroration; a more or less developed streak of dark fuscous suffusion or irroration along fold from base throughout, and thence along termen to apex: cilia pale greyish-ochreous, at apex with a dark fuscous basal mark. Hindwings pale grey; cilia whitish-grey.

British Guiana, Bartica and Mallali, from December to March (*Parish*); nine specimens.

Erechthias zebrina, Butl.

British Guiana, Bartica and Mallali (*Parish*); common. Unquestionably *lanceolata*, Wals., and *xenica*, Meyr., are synonyms of this; I have it from the West Indies, Hawaiian Islands, Borneo, India, Ceylon, and the Seychelles, doubtless a refuse-feeder and artificially spread.

TINEIDAE.

Acrolophus exigua, n. sp.

♂. 10–17 mm., ♀ 26–27 mm. Head, palpi, and thorax dark fuscous sprinkled with whitish, palpi in ♂ extremely long, recurved, reaching to beyond middle of thorax, clothed with loose rough scales, suffused with fuscous-whitish towards base. Antennae in ♂ strongly bipectinated, pectinations slender. Abdomen dark fuscous, uncus moderately long, gently curved, slender, branches closely appressed throughout, claspers narrow, somewhat enlarged and slightly rounded at apex. Forewings elongate, moderate, costa gently arched, apex rounded, termen rather obliquely rounded; all veins separate; grey closely irrorated with dark fuscous, with some obscure scattered blackish strigulae: cilia grey mixed with dark fuscous. Hindwings dark fuscous; cilia grey, with dark fuscous subbasal shade.

British Guiana, Mallali, in March (*Parish*); five specimens.

Acrolophus halidora, n. sp.

♂. 17–19 mm. Head, thorax, and abdomen rather dark fuscous; uncus long, curved, branches moderately separated throughout, claspers rather narrow towards base, oval-dilated apically. Palpi extremely long, recurved, reaching to beyond middle of thorax,

clothed with very dense loose scales, fuscous or whitish-fuscous, externally suffused with darker fuscous, especially towards base. Antennae flatly lamellate. Forewings elongate, moderate, somewhat dilated posteriorly, costa gently arched, apex rounded, termen somewhat obliquely rounded; all veins separate; light fuscous, more or less mixed or strigulated with dark fuscous, costa brown spotted with dark fuscous; a semioval blackish blotch beneath middle of disc, suffused above, sharply defined beneath and edged with brown suffusion, sometimes extended as a suffused brown patch to base; a group of a few whitish scales in disc at $\frac{2}{3}$, preceded by some undefined blackish suffusion: cilia fuscous. Hindwings rather dark grey; cilia grey.

British Guiana, Bartica and Georgetown, from December to April (*Parish*); four specimens.

Acrolophus echinura, n. sp.

♂. 37–41 mm., ♀ 48–52 mm. Head, palpi, and thorax dark brown; palpi in ♂ extremely long, recurved, reaching to extremity of thorax, strongly thickened throughout with dense rough projecting scales. Antennae in ♂ strongly bipectinated, pectinations slender. Abdomen light fuscous, uncus moderate, curved, branches approximated throughout, claspers broad, rounded, apical edge set with numerous short acute spines or teeth in three rows. Posterior tarsi with basal joint rough-scaled above. Forewings rather broad, slightly dilated, in ♀ more elongate, costa gently arched, apex rounded, termen rounded, somewhat oblique; all veins separate; deep purplish-brown, with small obscure scattered dark fuscous strigulae, in ♀ more ochreous-tinged; costa strigulated with dark fuscous; a suffused subquadrate dark fuscous spot in disc at $\frac{2}{3}$, and one trapezoidal or triangular beneath middle of disc: cilia fuscous, with two darker shades. Hindwings rather dark fuscous; cilia fuscous.

Peru, Chanchamayo, 3500 feet, and Oconoque, 7000 feet, in February; fourteen specimens.

Acrolophus rupestris, Wals.

I have examples of this species from Jamaica with veins 2 and 3 of forewings well separated, as well as others with them stalked; and therefore the genus *Apoclisis,* Wals., founded for this species on the latter structure (Biol. Centr. Am. IV, p. 380) also lapses into a synonym, like his eleven others.

NEPTICULIDAE.

Nepticula eurydesma, n. sp.

♂ ♀. 3–4 mm. Head ferruginous-yellow, collar and eyecaps white. Thorax dark purplish-fuscous. Abdomen bronzy-grey. Forewings short-lanceolate; dark purplish-fuscous; a broad ochreous-white median transverse fascia, dilated on dorsum: cilia grey. Hindwings rather dark grey; cilia grey.

British Guiana, Georgetown, in April (*Parish*); five specimens.

Nepticula epicosma, n. sp.

♂. 3–4 mm. Head ochreous or yellowish, eyecaps whitish. Thorax coppery-bronze. Abdomen leaden-grey. Forewings rather short-lanceolate; dark purplish-fuscous, basal third bronzy; a rather oblique pale golden-metallic fascia beyond middle; a rather narrower curved pale golden-metallic fascia round apex: cilia dark grey, towards tips grey-whitish. Hindwings dark grey; cilia grey.

Peru, Lima, 500 feet, in August (*Parish*); three specimens.

Nepticula cuprata, n. sp.

♂. 4 mm. Head ochreous-whitish. Thorax and abdomen bronzy-grey. Forewings lanceolate; glossy bronzy-grey; a moderate transverse silvery-whitish fascia at $\frac{3}{5}$; apical area beyond this coppery-tinged: cilia grey. Hindwings and cilia grey.

Peru, Matucana, 7780 feet, in July (*Parish*); two specimens.

Nepticula aerifica, n. sp.

♀. 5–6 mm. Head and eyecaps ochreous-grey-whitish. Thorax greyish-bronze. Abdomen grey. Forewings lanceolate; rather dark greyish-bronze, apical area darker and tinged with coppery-purple; a rather obscurely defined brassy-silvery transverse fascia at $\frac{3}{4}$: cilia pale bronzy-grey. Hindwings grey; cilia pale grey.

Peru, Oroya, 12,200 feet, in July (*Parish*); two specimens.

Nepticula andina, n. sp.

♂ ♀. 4–6 mm. Head and thorax whitish-ochreous, hairs of crown sometimes pale yellow-ochreous. Eyecaps whitish. Abdomen pale grey. Forewings lanceolate; glossy whitish-ochreous, brassy-tinged, in ♂ posteriorly with shining whitish reflections; in ♀ a dark purplish-

fuscous patch occupying apical fourth of wing, edged anteriorly with shining whitish : cilia ochreous-whitish or grey-whitish. Hindwings pale grey; cilia grey-whitish.

Peru, Oroya, 12,200 feet, in July (*Parish*); twenty specimens (14 ♂, 6 ♀). Remarkable for the striking sexual difference of colouring.

Nepticula olyritis, n. sp.

♂ ♀. 3–4 mm. Head pale ochreous-yellowish, eyecaps whitish. Thorax ochreous-whitish sprinkled with dark grey. Abdomen grey. Forewings lanceolate; blackish-grey, coarsely and irregularly mixed or suffused with ochreous-grey-whitish except at apex : cilia grey, at apex with an ochreous-whitish patch. Hindwings and cilia grey.

Peru, Lima, 500 feet, in August (*Parish*); six specimens.

August 5, 1915

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VIII. *The Opisthomeres and the Gonapophyses in the* Dermaptera.

By Malcolm Burr, D.Sc., F.E.S.

[Read November 4th, 1914.]

The Opisthomeres.

If the forceps of an earwig be removed, it will be found that there is a strongly chitinised plate that extends from the posterior margin of the last tergite, bent downwards; this is the *pygidium*, the peculiar processes of which have long been familiar to Dermapterists as affording useful specific characters, especially in the Eudermaptera.

But if the pygidium be separated from the last tergite, it will be found that there is a second, and occasionally a third, smaller segment attached to it, which is tucked away above the penultimate sternite, and so only discernible upon dissection. This second plate in the metapygidium, and the third, when present, is the telson.

Verhoeff was the first systematist to realise the importance of these segments. He points out that Brunner refers to the telson under the name of sub-anal plate, but it was more probably the metapygidium that he saw, as the telson is but rarely developed. At the same time, Verhoeff called attention to these characters, which are better developed in the more primitive Protodermaptera, and gradually degenerate in the Eudermaptera.

The pygidium is the rudiment of the eleventh tergite, the metapygidium of the twelfth, and the telson of the thirteenth. These three segments are called by Verhoeff the opisthomeres. The first two are always present, but the telson is rarely chitinised : it is usually absent, or represented by a hyaline, delicate membrane.

The telson is an independent chitinised plate in the *Pygidicranidae* and *Pyragrinae*, and probably in the *Diplatyinae*. The figures of the Allostethine opisthomeres, and those of *Adiathetus tenebrator*, show an ill-defined membrane which I take to be the degenerate telson. But in the metapygidium and pygidium there are often visible transverse sutures, which seem to suggest a fusion of two plates.

Zacher maintains that the metapygidium fuses with the telson, and not with the pygidium, and that the line of demarcation is visible. I am not inclined to follow him. It is difficult to understand his description, as he gives no figures : he discusses the opisthomeres of *Allostethus* in some detail. As I read them (see fig. 5) the broad basal segment is the pygidium, the second, lobed segment metapygidium and the transparent membrane represents the telson. It is very noteworthy that the opisthomeres are of quite different forms in the two sexes. Fig. 5 represents the segments in the male, figs. 6 and 7 in the female and in the nymph.

In the *Psalidae* we can just detect the remains of the telson, but the pygidium seems, in its construction and pattern, to indicate a fusion of two segments : if that is so, the first segment is the pygidium and metapygidium united, the short transverse second plate the metapygidium, and Zacher is right : if this is so, the telson has no significance.

In Verhoeff's formula for the Forficuline abdomen, his eleventh tergite is the pygidium and metapygidium united, and so should read 11×12, while the telson is the thirteenth.

In *Kalocrania* sp. we find the pygidium very broad at the base, obtusely triangular, with a three-legged ridge

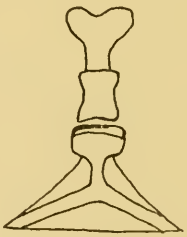


Fig. 1.—*Kalocrania*, sp. ♂.

radiating from a central point, the apex of the posterior ridge terminating in a rectangular lobe : the metapygidium is quite separate, nearly rectangular, longer than broad, but decidedly shorter than the pygidium : the telson again is quite distinct, narrower than the metapygidium but dilated at the apex, forming two rounded lobes separated by a rounded emargination.

In *Pyragra fuscata* we have an analogous arrangement, the pygidium being transverse and in the form of an obtuse-angled triangle, with the apex truncate, at which point is the clear junction with the metapygidium, which narrows

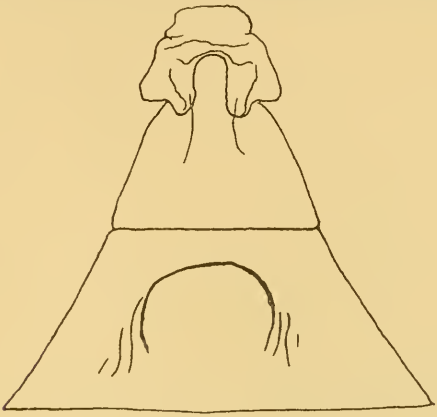


Fig. 2.—*Pyragra fuscata*, Serv.

towards the apex: the telson seems to be intimately connected to the metapygidium, and is of irregular shape, but smaller than the pygidium. The latter has a well-marked median depression.

In *Diplatys gladiator*, the pygidium is broad at the base,

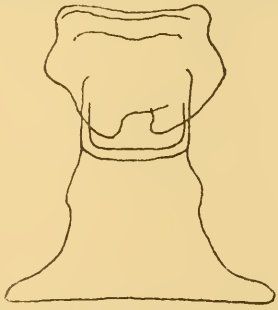


Fig. 3.—*Diplatys gladiator*, Burr, ♂.

but abruptly narrowed, the sides being nearly parallel: beyond this point, the detail is obscure in my specimen, but there seems to be a rectangular metapygidium clearly joined to the pygidium, and a broader, irregularly shaped telson.

In *Echinosoma afrum*, Beauv., I can see only two plates, which are strongly transverse: a faint suture perhaps indicates the fusion of the metapygidium with the

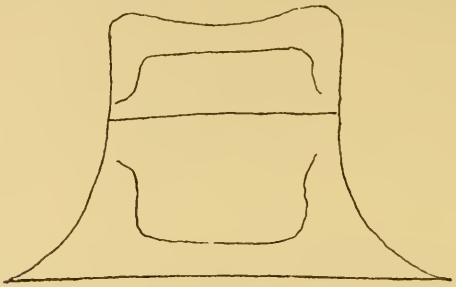


Fig. 4.—*Echinosoma afrum*, Beauv., ♂.

pygidium; the telson appears only represented by a faint membrane.

In the *Allostethinae*, Zacher says that all three plates are equally big, with which I cannot agree at all. In all my

Fig. 5.—*Allostethus indicum*, Hag., ♂.

specimens of this group, the pygidium is far bigger than the rest of the opisthomeres, being of the same shape as in *Pyragra*. In the female and nymph of *All. indicum*, the metapygidium is constricted about the middle, then strongly

dilated, with a semicircular convex margin : beyond this is quite discernible a broad, transverse, very feebly chitinised plate, with some bristles, which is the telson, already becoming weaker. In adult males the telson is even more

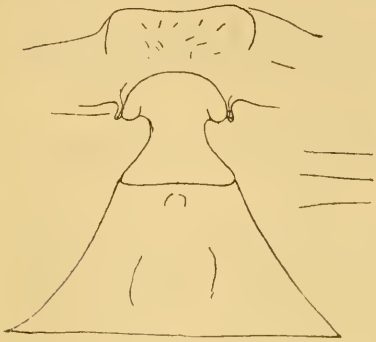


Fig. 6.—*Allostethus indicum*, Hag., ♀.

Fig. 7.—*Allostethus indicum*, Hag., ♂ *Nymph.*

membranous, with no defined edges, and the metapygidium nearly parallel-sided, with a pair of broad, pointed lobes at the angles, and a concave posterior margin. As Zacher points out, the female retains the more primitive form of opisthomeres, as she does of the forceps.

In the male of *Gonolabidura astruci* we find a very similar structure. The lobes on the metapygidium recall those

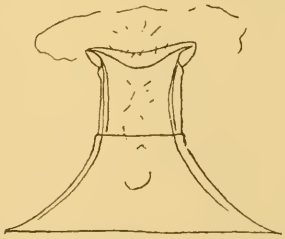


Fig. 8.—*Gonolabidura astruci*, Burr, ♂.

of the telson in *Pygidicrana*, which is perhaps Zacher's reason for identifying this plate as a fused telson and metapygidium.

In the *Psalidae* we find indications that the basal plate consists of the metapygidium fused with the pygidium : the following are my reasons :—

(i) The basal plate shows traces of a suture in *Euborellia moesta*.

(ii) The broad base and constricted waist suggest the similar form seen in the two distinct corresponding plates in *Allostethidae*.

(iii) The rounded lobes at the apex of the basal plates seem to correspond with the lobes at the outer corner of the metapygidium in the *Allostethidae*.

On the other hand, I admit that—

(i) The apical plates show transverse lines which may be the suture indicating fusion of metapygidium and telson.

(ii) In *Psalis pulchra* and *Euborellia moesta* the apical margin of the apical plate is membranous and seems in the former to have a distinct outline, so that this may be the degenerate membranous telson.

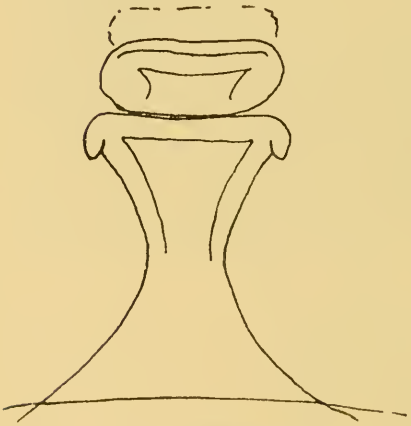


FIG. 9.—*Psalis pulchra*, Rehn, ♂.

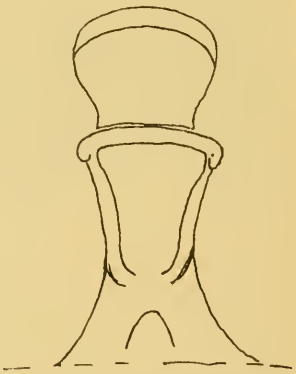


FIG. 10.—*Euborellia moesta*, Géné, ♀.

But on the whole I am inclined to regard the basal plate as the pygidium, the apical one as the metapygidium, and the faint apical membrane as the remains of the telson.

Zacher states that the suture between telson and metapygidium is sometimes visible, but refers to the apical plate as the supra-anal plate, which name he always uses for the telson.

In the *Brachylabinae*, I have examined the opisthomeres of *Nannisolabis formicoides*. Here we have only two plates : the basal one is about twice as long as broad, and gently constricted about the middle; this I take to be the pygidium; the apical plate is of the same breadth, but decidedly transverse, and this I take to be the metapygidium, the telson having gone.

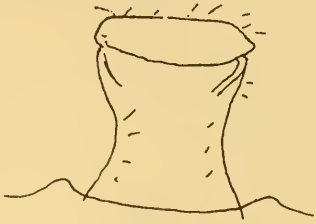


Fig. 11.—*Nannisolabis formicoides*, Burr, ♂.

On Zacher's interpretation, the large basal plate is the pygidium, the small apical one the metapygidium and telson fused.

At the external angles of the basal plate we see traces of the crests or keels, or strong chitinisation which is so well seen in the *Psalidae* figured, and in the metapygidium of the Allostethids.

In *Labidura riparia* we have an extreme form : there are only two plates; the pygidium shows no trace of suture

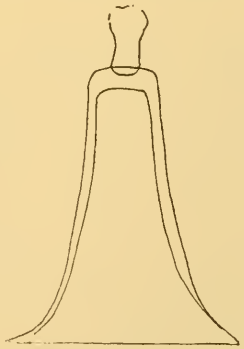


Fig. 12.—*Labidura riparia*, Pall., ♂.

or junction, is very large, and much longer than broad, with the sides reinforced; the apical plate or metapygidium is very small and narrow, longer than broad.

Verhoeff calls the big plate the pygidium, the small one the supra-anal plate, which is the same as the telson; Zacher also calls it the supra-anal plate, adding that no trace of the metapygidium remains, by which he implies, I suppose, that the latter has been entirely absorbed in the telson.

Perhaps we are both wrong, as the interpretation may be that the pygidium is very big, the metapygidium very small, and the telson disappeared; or that the metapygidium is fused into the pygidium.

I have unfortunately no Labiine opisthomere available at the moment, but those of the Chelisochid *Adiathetus tenebrator* are very remarkable. The basal plate is a little longer than broad and shows a reinforcement which may

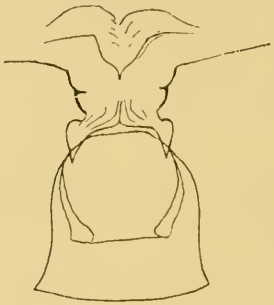


Fig. 13.—*Adiathetus tenebrator*, Kirby, ♂.

represent the absorbed metapygidium. The apical segment, which may be the metapygidium, or the telson, or both, is complex: there is an irregularly shaped, chitinous plate, with a deep incision in the posterior margin, which throws off laterally long acute lobes which are but feebly chitinised, apparently the homologues, the rounded or strengthened lobes of the Psalis or Allistethid opisthomeres: beyond this is a faint membrane, with a few bristles, which I read as the telson. If this is so, we have here a more generalised form of opisthomeres than in the *Brachylabidae* and in *Labidura*.

Of the *Anechurinae* I have examined two species, *Mesochelidura bolivari*, and *Anechura bipunctata*: in both, there is no trace of any third plate. The basal one is broad at the base, gradually narrowed towards the truncate apex. The apical plate is folded backwards at this

junction is a little longer, or shorter, respectively, than the basal plate, and as broad, the margin gently sinuate with rounded angles.

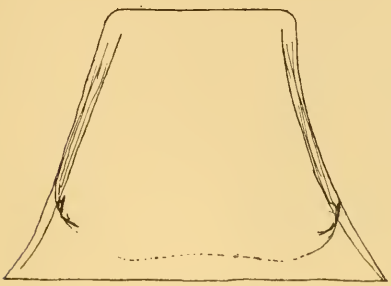


FIG. 14.—*Anechura bipunctata*, Fabr., ♂.

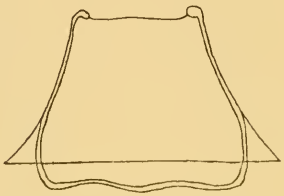


FIG. 15.—*Mesochelidura bolivari*, Borm., ♂.

In the former, there are chitinised knobs at the angles at the junction.

In *Forficula auricularia*, I have both sexes to offer. In both the basal plate is longer than broad, and slightly constricted, and the angles somewhat prominent: that of the male shows a different pattern from that of the female. The apical plate is more convex: in both the sides are irregular, and there are traces of a transverse suture,

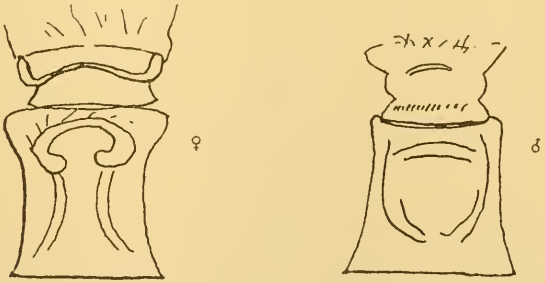


FIG. 16.—*Forficula auricularia*, L.

certainly suggestive of a fusion of two plates, more marked in the more primitive female than in the more specialised male: in both the posterior margin is weakly chitinised, with a few bristles.

I am bound to admit that it looks as though we have here a fusion of the metapygidium with the telson.

Apterygida albipennis shows a similar structure.

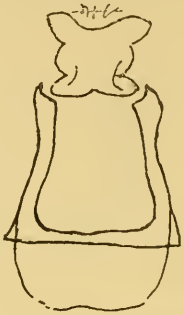


Fig. 17.—*Apterygida albipennis*, Meg., ♂.

In the primitive *Arixenia*, we should expect to find generalised opisthomeres; it is therefore surprising to find in the male of *A. jacobsoni* only two plates, the basal one nearly square, the apical one of the same breadth, but less than half as deep. Neither show any trace of suture or fusion, nor any specialisation.

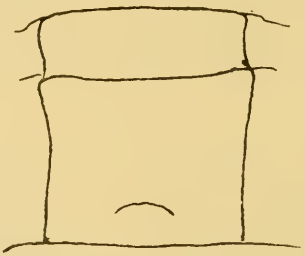


Fig. 18.—*Arixenia jacobsoni*, Burr, ♂.

The Gonapophyses.

If we lift the last sternites in the females of certain Protodermaptera, we find two sets of paired appendages termed the gonapophyses, supposed to be the homologues of the four valves of the ovipositor of the true Orthoptera.

Zacher was the first, as far as I am aware, to call attention to these structures in the Dermaptera, and he figures a few instances. We reproduce a copy of his figure showing the under surface of the extremity of the abdomen in the female of a species of *Kalocrania*, where BB

represent the gonapophyses of the ninth, and AA those of the eighth, segments. The thread-like appendages are

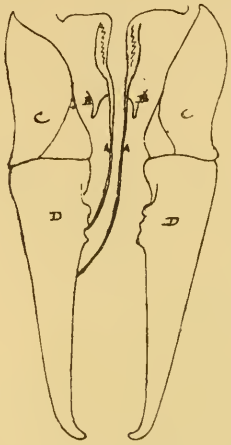


Fig. 19.—*Kalocrania*, sp. ♀. Apex of venter showing gonapophyses.

often to be seen protruding between the branches of the forceps; they are also thread-like in *Anataelia*, and in the *Diplatyinae*.

In the Echinosomatine the first pair is long and slender, though scarcely thread-like, while the second pair are

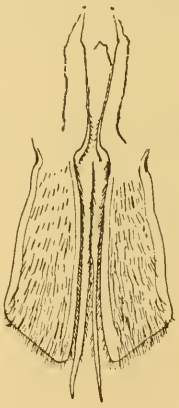


Fig. 20.—*Echinosoma afrum*, Beauv., gonapophyses.

developed into large, dilated, flat, pubescent lobes; the shape of these lobes may offer useful characters, and enable

us to define the species in this difficult group. Zacher figures the gonapophyses of several species; I add those of *Echinosoma afrum*.

The existence of gonapophyses in the *Allostethinae* has apparently been hitherto overlooked, even by such acute observers as Verhoeff and Zacher, so I was rather surprised to come across them; both pairs are in the form of short, rounded lobes, of about equal size; unfortunately, I had no fresh nor spirit-preserved material available for study in this case, but was obliged to dissect very old dried specimens, after treatment with potash; owing to the dirt accumulated from the decomposition and desiccation of the contents of the abdomen, all the specimens were obscured and discoloured, and I was not able to produce a satisfactory mount for illustration.

These curious organs have not yet been investigated with anything approaching thoroughness, and it remains to be ascertained whether they are of use to the possessor from a functional, or to the entomologist from a taxonomic, point of view. They certainly are a primitive feature; they have not yet been recorded in the Eudermaptera, nor in the *Labiduridae*, with the above-mentioned exception of the *Allostethinae*; till they were found here, they were considered to be characteristic of the *Pygidicranidae*, since they occur in the *Diplatyinae*, *Anataelinae*, *Pygidicraninae*, and the *Echinosomatinae*. Unfortunately for the sake of symmetry, they seem to be absent in the *Pyragrinae*, though they may yet be detected here when fresh specimens are available.

But the facts so far adduced place us at once in a dilemma; are we to place the *Allostethinae* in the *Pygidicranidae*, in spite of its undoubted Labidurine affinities? They seem really to represent an intermediate group, with highly characteristic features of their own, which they do not share either with the *Pygidicranidae*, or with the *Labiduridae*.

IX. *Note on the* Manubrium *of the Ninth Sternite in the Male Earwig.* By Malcolm Burr, D.Sc., F.E.S.

[Read November 4th, 1914.]

Plates XXX—XXXIII.

An organ which has been almost totally neglected by writers on the Dermaptera, whether taxonomists or anatomists, is the Manubrium of the ninth sternite of the male. The majority of authors, indeed, appear to be totally ignorant of its existence. Verhoeff, it is true, noticed its great length in the *Psalinae*, writing of this group, in 1901, that "Subgenitalplatte des ♂ vorne mit recht langen endoskelettalem Fortsatz, der jederseits einen Verdickungsfaden zeigt." Ten years later, Zacher figures the incomplete manubrium of *Anisolabis verhoeffi* (1911, fig. W[1]), but without comment. Jordan and Burr describe it with a figure, in the case of *Arixenia jacobsoni* (fig. 14, p. 403). Jordan refers to it as a special sclerite, it being distinct from the ninth sternite in that group, and suggests that its function may be that of a support to the penis. This might be the case in *Arixenia*, where the organ in question is short, transverse and so structurally strong, but its great length and extreme narrowness in the *Psalidae* deprive it of all rigidity.

If we dissect out the ninth sternite of a male earwig, we find on the basal, inner margin, an extension of the chitin, consisting of a fine hyaline membrane supported by a thread-like indurated chitinous frame. This is the manubrium. In most groups it is short, rarely much longer than broad, but it is extremely prominent in the *Psalinae*. The acompanying photographs, for which I am indebted to the Rev. F. D. Morice, illustrate the various forms of this organ in sundry groups; unfortunately, the material has not always been of the best, the organ itself being sometimes torn and distorted, or sometimes obscured by bunches of torn muscular fibre which remain adhering to the plate; still, the illustrations illustrate the range of variety in form and design of this organ in most of the subfamilies of the Dermaptera. This diversity encourages us in the hope that from the manubrium we shall be able to draw some very valuable characters.

As will be seen from the following observations, we have already been able to make good use of the manubrium in two cases—that is, the definition of the *Psalinae*, and the separation therefrom of "*Psalis*" *femoralis*.

In the *Diplatyinae*, I am able to show the manubrium in three species, all Indian; in none of these is it prominent, only a slight extension of the basal edge of the plate being discernible.

Of the *Pygidicraninae*, we have the case of *Kalocrania picta*, Guér. Here it is a trifle longer than broad, rounded at the tip, with the sides parallel.

In the *Pyragrinae*, we are able to figure it in four species, representing two genera; i. e. *Pyragra dohrni* and *P. fuscata*, Serv., and *Pyragropsis paraguayensis* and *P. thoracica*, Serv. In all of these it is rather transverse and broadly rounded, approaching the semicircular.

In the *Echinosomatinae*, the figure of *E. sumatranum* shows it to be very similar in that group.

Passing from the *Pygidicranidae* to the *Labiduridae* we find it triangular in *Esphalmenus camposi*, Bor., but whether this is of specific or of generic importance remains to be seen; the figure of this species shows prominently the characteristic apical incision, with lobes, of the transverse ninth segment of that species.

In the *Labidurinae*, we find an almost rectangular manubrium in the case of *Labidura riparia*; it will be interesting to see if this form occurs also in the allied *Nala* and *Forcipula*.

We now come to the *Psalinae*, and here we meet with a startling change. The eight species figured show the very prominent, disproportionately long, manubrium, which I now take as the distinguishing character of this group. There is a general similarity of structure in each case, but the actual length of the manubrium varies, especially in proportion to the length of the sternite, which is in itself a very useful feature. This is seen in *Euborellia penicillata*, Bor., from South India, where it is not twice as long as the sternite, nor indeed scarcely more than $1\frac{1}{2}$ times as long, but in *Eulabis saramaccensis*, Zacher, it is nearly three times as long.

In *Psalis americana*, Beauv., and *Carcinophera robusta*, Scudd. (= *Psalis gagatina*, Klug), it is at the base about a third as wide as the sternite, but rapidly narrowed; the sides then meet, and diverge only at the apex to form a

small dilatation : the total length is about twice that of the sternite.

In *Psalis pulchra*, Rehn, the sternite is about as broad as long, the posterior margin with a shallow, rounded emargination, and a pair of tufts of small bristles : the sides of the manubrium are remote at the base, but less so than in the preceding species, rapidly converge, and gently dilate towards the apex. The total length is about double that of the sternite. In *Labidurodes robustus*, Dubr., it is shorter than the sternite, narrow at the base, and dilated at the apex.

In *Euborellia greeni*, Burr (in a specimen from the Shervaroy Hills), it is three times as long as the sternite, the sides almost contiguous at the base, and feebly dilated at the apex.

In *E. stâli*, Dohrn, the sternite is about as broad as long, the manubrium, nearly three times as long, almost contiguous at the base.

In *Gonolabis picea*, Bor., the sternite is transverse, and the manubrium, as in *E. stâli*, is about three times as long as the plate itself. In *Anisolabis infelix*, Burr, it is about twice as long, and in *Euborellia moesta*, Géné, it is a little less than twice as long.

When we come to *Psalis femoralis*, Dohrn, we find quite a different type of manubrium, which is relatively broad, the length being about double the width, and the tip itself broadly rounded ; it is obviously not a *Psalidine* manubrium, approaching more nearly to that of *Labidura*; but the male genital armature is also quite characteristic, and at once different from that of the *Psalinae* and of the *Labidurinae*; this will be described and figured in another paper, where I shall propose the erection, not only of a new genus, but even of a new subfamily, for the little brown Indian and Singalese earwig that is known as " *Psalis* " *femoralis*.

In the Eudermaptera, we do not find very much variety ; the species illustrated, representing seven genera, belonging to the *Labiinae*, *Chelisochinae*, *Anechurinae* and *Forficulinae*; they are rather broad and short, gently narrowed at the tip; only in *Marava wallacei*, Dohrn, do we find different form; but this is a single specimen, in not very good condition.

Explanation of Plates XXX—XXXIII.

PLATE XXX.

Fig. 1. *Kalocrania picta*, Guér.
2. *Pyragra saussurei*, Dohrn
3. *Propyragra paraguayensis*, Bor.
4. ,, *thoracica*, Serv.
5. *Echinosoma sumatranum*, Haan
6. *Pyragra dohrni*, Sauss.

PLATE XXXI.

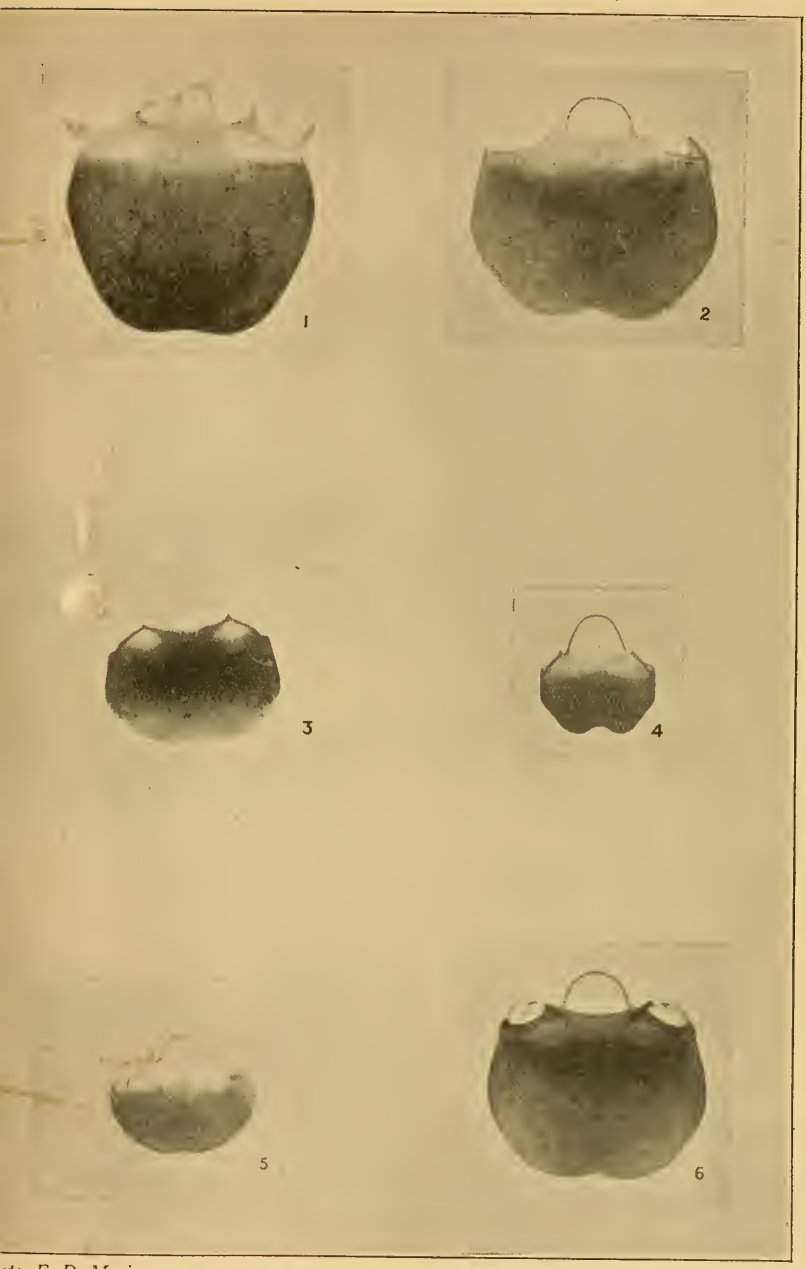
7. *Diplatys rufescens*, Kirby
8. ,, ,,
9. ,, *gladiator*, Burr
10. ,, *bormansi*, Burr
11. ,, ,,
12. *Esphalmenus camposi*, Bor.
13. ,, ,,
14. *Labidura riparia*, Pall.
15. "*Psalis*" *femoralis*, Dohrn

PLATE XXXII.

16. *Psalis dohrni*, Kirby
17. *Euborellia penicillata*, Bor.
18. ,, *ståli*, Dohrn
19. *Anisolabis owenii*, Burr
20. *Euborellia penicillata*, Bor.
21. *Psalis pulchra*, Rehn
22. *Euborellia moesta*, Géné
23. *Eulabis saramaccensis*, Zacher.

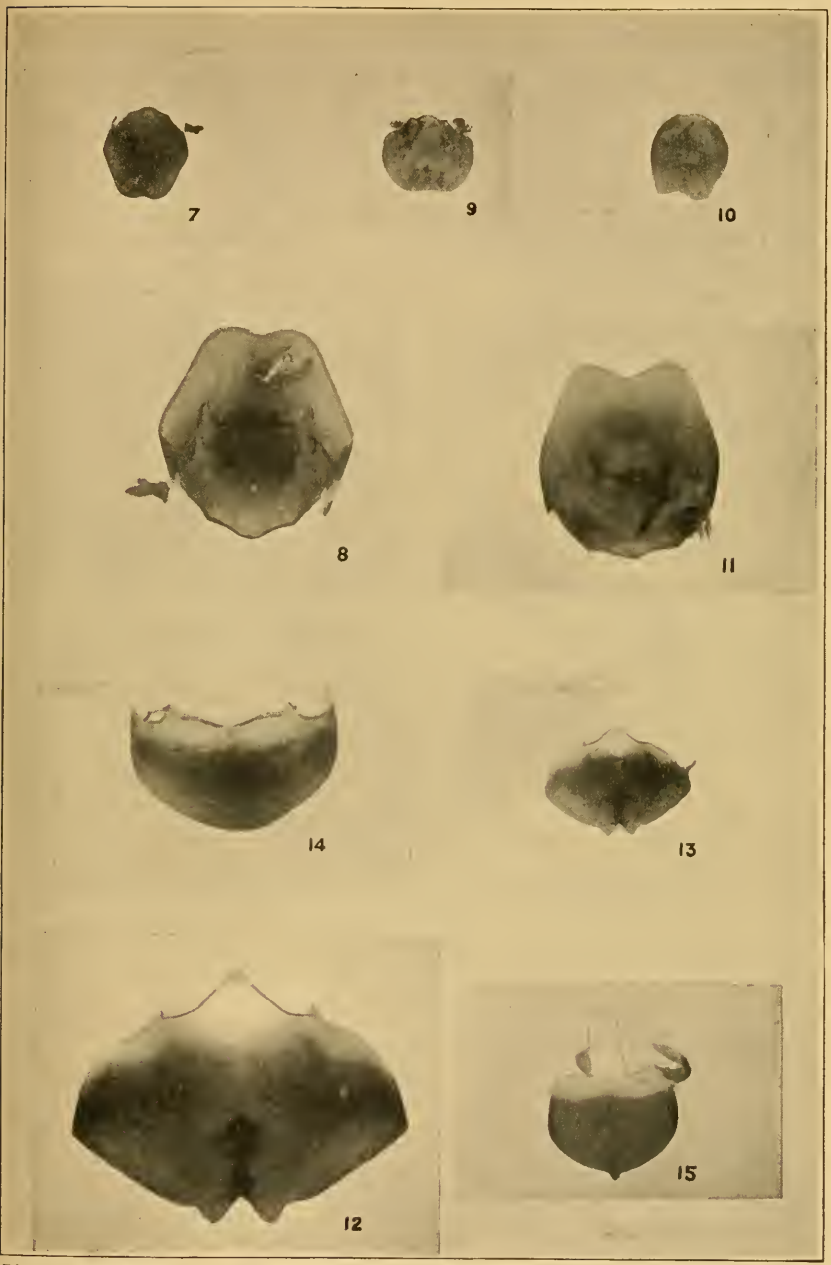
PLATE XXXIII.

24. *Chaetospania thoracica*, Dohrn
25. *Spongorostox assinilasis*, Borm.
26. *Marava wallacei*, Dohrn
27. *Mesochelidura peringueyi*, Borm.
28. *Kosmetor*, sp. n.
29. *Chelisoches morio*, Fabr.
30. *Apterygida cavalli*, Bor.
31. *Forficula auricularia*, L.



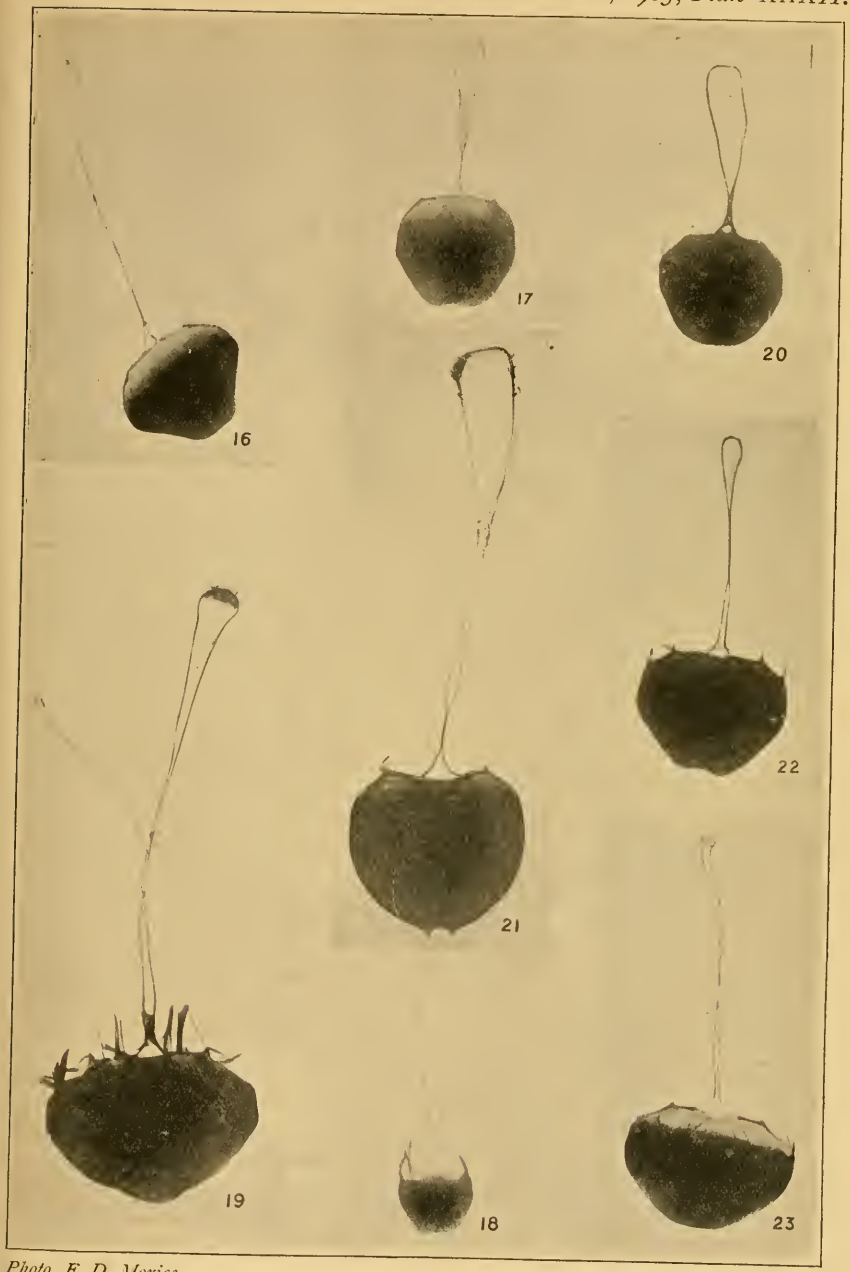
oto, F. D. Morice.

MANUBRIUM OF DERMAPTERA.



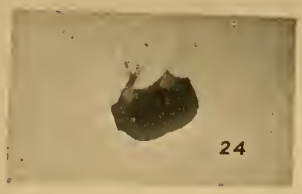
Photo, F. D. Morice.

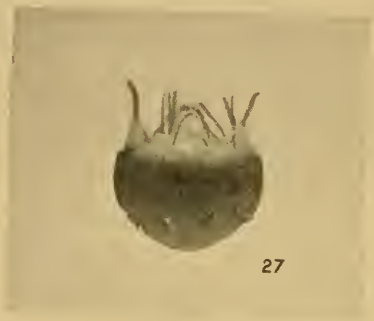
MANUBRIUM OF DERMAPTERA.



Photo, F. D. Morice.

MANUBRIUM OF DERMAPTERA.





Photo, F. D. Morice.

MANUBRIUM OF DERMAPTERA.

X. *Some Palaearctic species of* Cordulegaster. By Kenneth J. Morton, F.E.S.

[Read May 5th, 1915.]

Plates XXXIV–XXXVII.

During recent years a considerable number of examples of the genus *Cordulegaster* have come into my hands from different localities in the Palaearctic region, amongst them some which I have not been able to identify satisfactorily with existing descriptions.

The high standard of excellence in descriptive work reached in the Monographie des Gomphines (de Selys with Hagen's collaboration, Mem. de la Soc. Roy. des Sciences de Liége, Tome xi, pp. 257–720, 1858) does not appear to have been maintained. De Selys' last revision of the species of *Cordulegaster* found in Asia Minor and Europe is too brief and general (Odonates de l'Asie Mineure, Ann. Soc. Ent. Belg., xxxi, pp. 31–35), and does not leave the subject beyond the need of further treatment. The following notes may therefore be helpful as a small contribution to a better knowledge of these splendid insects.

The material dealt with (in addition to ample series of *C. annulatus* collected in Great Britain mostly by myself, but also including series given to me by the Hon. Mr. Rothschild from Devonshire, Mr. Mosely and others) has been received from various sources: France (Morton), Spain (Dr. Chapman, Miss Fountaine, Morton), Switzerland (Dr. Ris), Herzegovina (Miss Fountaine), Constantinople (Mr. Graves), Algeria (Miss Fountaine), the Caucasus (M. Bartenef), Amasia and Van, Asia Minor (Prof. Manissadjian), and lastly, from Messrs. Staudinger and Bang-Haas, Dresden, some very interesting insects from the Caucasus and Fergana.

The species referred to may be divided into two groups—

I. Superior appendages of ♂ with only one visible tooth: group of *C. annulatus*.

II. Superior appendages of ♂ with two teeth: group of *C. bidentatus*.

Cordulegaster annulatus, Latr.

♂. Face yellow with black hairs; a short transverse rather broad black frontal line; rhinarium black, forming a broad transverse band which encroaches slightly upon the anterior margin of the nasus; labrum yellow, narrowly bordered with black at base and on the sides but not in front, the black forming a little projection in the middle (virgule) not reaching the margin. Labium and palpi reddish yellow; vertex and ocelli black, this colour also bordering in a sinuous manner the base of the frons and descending narrowly along the eyes; occiput small, yellow, furnished with a crest of yellow hairs; it is swollen especially behind, where it is almost bi-vesiculous, marked with a sunken black point. Back of the eyes black with a white band bordering the eyes towards the genae.

Eyes of a brilliant green in life.

Prothorax black, bordered with yellow in front and behind, where this colour is interrupted in the middle of the margin.

Thorax hairy, black marked with yellow, thus: two cuneiform bands in front, and two oblique isolated equal bands on each side, the last not terminal. Between these bands a line divided into two or three spots or entire. There are also an upper humeral point, a point at the wing attachments, an inter-alar spot between each of the wings, double between the hindwings; finally, the basal articulation of the legs and the breast are marked with yellow.

Abdomen cylindrical; constricted between segments 2–6, a little broader between 7–8, shining black, annulated and spotted with yellow, thus: 1st segment with a half-ring interrupted before the end; 2nd with a dorsal ring, rather broad, median above, becoming basal upon the sides comprising the oreillettes which are moderate, denticulated with black at the end, and a second ring, terminal, interrupted by the dorsal arête and sometimes upon the sides; 3rd, 4th, 5th, 6th with a moderate median ring, and a narrow posterior one divided in two by the dorsal arête, which remains black; these rings do not exist on the under side of the segments; 7th and 8th having the rings a little nearer the base, more interrupted in the middle; the terminal ring absent on 8th; the 9th with a little basal lateral spot; 10th quite black, its posterior margin a little projecting and depressed in the middle.

Anal appendages black, superior a little shorter than the last segment, closely approximated at their base, almost compressed vertically, a little divergent; the outer margin thickened, almost straight or a little sinuous; the inner margin tapering to the point, which is fine and sharp, and this side presenting in its first fourth a strong

tooth bent towards the base; the margin is then dilated more or less and slightly emarginate before the point.

Inferior appendage one-third shorter than the superior, almost quadrate, broader than long, a little notched at the end, the lateral margins swollen, turned up at the extremity and pointed.

Legs all black.

Wings hyaline, often a little darkened. Neuration black, costa yellow externally; pterostigma long, slender, black, surmounting nearly 4 cellules; membranule rather large long whitish; anal margin little excavated, the angle nearly right-angled. Triangle of the 4 wings divided by a nervule; internal triangle free; 18–21 antenodals in the superior; 13–15 in the inferior; 13–15 post-nodals in both pairs.

♀. Resembles the ♂ in colour, even in the labrum; but the abdomen is less constricted in the middle and the oreillettes very rudimentary.

The vulvar margin is prolonged in two chitinous laminae, surpassing the end of the abdomen by more than 3 mm. They arise at the base of segment 9, are contiguous, are hollow internally, and finish in a point simulating the lower mandible of a *Motacilla*; they are applied against the underside of the abdomen, of which they support segments 9 and 10, which are in some degree soft, their dorsal part being of a nature much less hard than that of the other segments. The base of each of these laminae is marked by a rounded yellow spot which in dried examples becomes often brown. Segment 10 is often marked with yellow on the sides.

The anal appendages, one-third shorter than the last segment, are slender, cylindrical, brown, with a sharp black point, separated by strong protuberance, brown, hairy, which terminates the abdomen.

Pterostigma longer, brown, surmounting 5–6 cellules.

	♂	♀
Length of abdomen . . .	55–57 mm.	55–62 mm.
,, forewing . . .	43–45 ,,	47–50 ,,
,, hindwing . . .	43–45 ,,	47–50 ,,
Pterostigma, forewing . .	4¼ ,,	4½–5 ,,
,, hindwing . .	5 ,,	5–5½ ,,
Vulvar lamina	—	8½ ,,

(After de Selys, Mon. des Gomphines, pp. 593–5.)

The principal characters may be summarised thus—

♂. Frons yellow with a transverse frontal line of variable breadth; nasus yellow margined with black anteriorly; rhinarium black;

labrum margined with black posteriorly and at the sides; median virgule of labrum black and well marked. Occiput yellow, swollen above and behind, hairs yellowish. Behind the eyes black with a narrow white line running along the lower part of each eye.

Prothorax black; fore and hind margin yellow, the latter interrupted in the middle.

Thorax with two large cuneiform yellow bands in front, a minute humeral yellow dot; two large lateral bands and between them a narrow irregular band sometimes interrupted.

Abdomen black with yellow markings as follows: on 1st segment a narrow band on the lower posterior part of the segment; 2nd segment with a median dorsal band and a large anterior lower space including the oreillettes, also a narrow posterior band sometimes interrupted on the dorsal arête and on the sides; segments 3 to 8 with median or sub-median bands more or less interrupted by the dorsal arête, 7 and 8 distinctly so; these bands except in 3 not actually touching the ventral suture but carried well over the sides of the segments; each of these segments with terminal lunules (*i. e.* representing the posterior bands) those of the last two being of a small size; 9 with a small lateral spot; 10 entirely black.

♀. Very similarly marked; segment 10 with a small lateral spot.

This typical form is widely distributed in northern and central Europe, including Scotland, Sweden and Denmark, and it goes as far eastward at least as Silesia. In southern France it seems to exist in the Pyrenees, and Navás records it from Portugal and many parts of Spain, including the Sierra Nevada. In other parts of southern France and of Spain it seems to be replaced by *immaculifrons*. De Selys says the latter is found in Italy and Austria, but the distribution of the two still remains to be satisfactorily worked out.

Race **immaculifrons**, Selys.

De Selys (Monographie des Gomphines, p. 595) says that the examples from the south of Europe differ more or less from those of the centre and north in this that the yellow occupies more space on the abdominal segments, while the frons is ordinarily all yellow without transverse anterior line. He gives the following as the principal points which serve to distinguish the best characterised southern examples—

The front is entirely yellow without transverse line; the

black border (proximal) of the labrum does not descend on the sides; the whitish border behind the eyes is broader; the yellow rings of the abdomen are broader and none of them interrupted by a dorsal arête; that of the 8th is much extended on the sides; the lateral spot of the 9th larger, and an analogous lateral yellow point on 10th. In some examples one sees a vestige of the black line on the frons; in others, the dorsal arête on the ring of segment 8 is finely black.

The females differ especially from northern examples by the great breadth of the median yellow rings of the abdomen, which in the 2nd and 3rd segments communicate on each side with the terminal rings in such a way as to isolate a black dorsal spot rounded behind upon the 2nd, pointed on the two sides upon the 3rd; the 8th segment is variable as to the dilatation of the ring, but this ring is always much interrupted above by the black dorsal arête. The front is very rarely entirely without spot; there is ordinarily a vestige. The black border of the labrum is incomplete as in the ♂. The wings in both sexes are often darkened (smoky at the extremity). In some examples they seem narrower than in the type and the costa externally is of a clearer yellow. (After de Selys.)

In a series of 9 males from Digne, Basses Alpes, there are two more or less distinct types of pattern, A being much the commoner. In B the yellow markings are more extended, and on the three last segments noticeably so. In 4 males (July 1902, Morton) there is no trace of the frontal line; in 3 of 6 examples (July 1914, Morton) there is a slight trace of this marking. Unfortunately I do not appear to have captured a ♀ in this locality.

In Spain the species is very interesting. 1 ♂ 2 ♀♀ from N.W. Spain (♂, Casayo. 2–8, vii. '06; ♀♀, Vigo, 18–27, vi. '06; Branuelas, 10–16, vii. '06, Chapman) are very close to northern *C. annulatus*. The frontal line is well marked in all; the sides of the 3 last segments in the females are rather more marked with yellow than in northern examples.

At La Granja, where the species is abundant at the clear streams there, the males are very similar in appearance to those found at Digne (form A); a fair proportion (4 out of 9) having the frontal line marked in varying degrees. A ♀ does not differ very greatly from the N.-W. Spanish females, but the yellow rings are rather broader and the frontal line is absent.

Unfortunately I failed to take the species at Albarracin, but I possess a ♂ from there (Miss Fountaine, 29, vi. '03) which shows a tendency towards the Algerian examples mentioned below. The shape of the dorsal marking on 2nd segment is much as in Fig. 5. The virgule on labrum is rather paler.

My acquaintance with *Cordulegaster* from northern Africa is restricted to three fine males from Algeria given to me by Miss Fountaine. On the whole these seem to be sufficiently well characterised to deserve a distinctive name.

Race **algiricus**, nov.

♂. Frons yellow without transverse frontal line; nasus yellow with the exception of two short black anterior lines; rhinarium black; labrum with the proximal margin black; virgule brownish; occiput yellow with yellow hairs. The white line behind the eyes broader than in *annulatus*.

Thorax: humeral spot when present extremely minute; median lateral band usually broken up into 4 spots.

Abdomen black with yellow markings. Median yellow band of segment 2, broad continued on the sides without interruption; posterior lunules large and connected by a narrow line with the lower yellow patch; dorsal black marking trilobate on anterior margin, the middle lobe narrowest and most prominent. On 3rd segment yellow dorsal marking occupies about $\frac{1}{3}$ of segment and is continued cephalad to the ventral suture and proximal edge of segment; in segments 4, 5 and 6 dorsal yellow markings not occupying quite $\frac{1}{3}$ of segment; yellow on 7th about $\frac{1}{3}$ of segment; lunules on segments 3 to 7, those on 3 and 4 large. Segments 8, 9 and 10 much marked with yellow above and on sides.

Antenodals: forewings 17–19; hindwings 12–14.

Length of abdomen 55–58 mm.

Length of wings 44–46 mm.

Pterostigma of forewings $3\frac{1}{2}$–4 mm.

,, hindwings 4–$4\frac{1}{2}$ mm.

3 ♂♂: Sebdou, 29, vi. 9. vii. '04; Tlemcen, 14, vii. '04.

Some time ago I received from Staudinger of Dresden a pair of *Cordulegaster* bearing the label "Tiflis Caucasus." They rank amongst the finest of the *C. annulatus* group, and, supposing no mistake has been made regarding the locality, they are of particular interest in respect that they appear to be nearer to the African than to the other races.

Race **princeps**, nov.

♂. Frons yellow without black markings; nasus yellow, rhinarium black; labrum yellow, basal margin bordered with black; *virgule not marked with black*; occiput yellow with yellowish hairs, swollen above and behind, deeply divided behind. *Behind the eyes entirely whitish with the exception of a black border running along the upper part of the eyes.*

Prothorax black, hind margin with a yellow line interrupted in the middle; anterior margin narrowly yellow.

Thorax: antehumeral yellow bands preceded by a small yellow subtriangular marking; yellow line between lateral bands small, broken up into three short lines all above stigma; no humeral dot visible.

Abdomen heavily marked with yellow; 1st segment black with a narrow yellow lateral hind margin, the yellow increasing towards the sternum; 2nd segment more than one-third yellow above, the black markings approximating on the side, but leaving a large yellow space including the oreillette on the lower anterior part of the segment; segments 3 to 7 with yellow dorsal markings occupying more than one-third of the segment, these markings extending laterally more in their anterior part but in no case reaching the ventral suture; a broad yellow band on segment 8, nearly reaching ventral suture; 9 segment marked with yellow anteriorly; and there seem to be traces of yellow on both anterior and hind margin of segment 10. Segments 2 to 6 with posterior lunules. Superior appendages from above much as in *annulatus* but longer, as long as last segment; outer margin nearly straight; closely approximated at the base, their inner margins, from the tooth, diverging regularly till about ¼ from the apex where they become parallel for a short space and then again diverge to the acute apex. Inferior appendage rather deeply emarginate.

♀. Similar: thorax with a small humeral spot. Abdomen: yellow dorsal marking on 2nd segment continued without interruption on the sides cephalad; segments 3 to 7 marked much as in the male; about half of dorsum of 8 yellow; yellow on 3, 4, 5 and 8 interrupted by black dorsal arête; segments 9 and 10 discoloured.

Wings in both sexes with the costa clear yellow. Antenodals: ♂, forewings 19–20, hindwings, 14; ♀, forewings 17, hindwings 12–14.

	♂	♀
Length of abdomen . .	59 mm.	61 mm.
,, wings	46·5 ,,	47 ,,
Pterostigma, forewings . .	3·5 ,,	4 ,,
,, hindwings . .	4 ,,	4·5 ,,
Vulvar lamina	—	8·5 ,,

Cordulegaster charpentieri, Kol.

♂. Frons yellow with fine black transverse line. Nasus yellow marked with black in front; rhinarium black. Labrum distinctly and completely surrounded with black margin; virgule black and distinct. Occiput above with black margins and blackish in the middle dividing the disc into two dusky yellowish patches; behind yellow, divided for a great part of its length by a dark line; hairs blackish. White line behind the eyes broader than in *C. annulatus*.

Thorax: humeral spot distinct; intermediate lateral band divided into two—a long spot of nearly equal breadth and a smaller triangular spot above the stigma.

Abdomen: lower part of distal half of 1st segment yellow; yellow dorsal band of segment 2 occupying about $\frac{1}{4}$ of segment, almost interrupted on side, the yellow again extending to the proximal margin and including the oreillette; black dorsal marking trilobate, middle lobe prominent; lunules distinct, not connected with lower lateral yellow markings. Yellow on segment 3 extending to fully one-third on dorsum; on 4 to about $\frac{1}{3}$; on 5, 6, 7 and 8 to about $\frac{1}{4}$; most of the median bands divided by the dorsal arête but otherwise nearly complete and continued to the ventral suture. Lunules apparently not indicated after 6th segment.

Appendages similar to those of *C. annulatus* but rather longer; narrower when viewed from above, divergent, turning slightly outwards towards the apex which is acute. Distal margin of inferior appendage nearly straight. (Compare Mon. Gomph., pl. 17, figs. 4 and 5, from Tuscany and Dalmatia.)

Antenodals: forewings 19–21; hindwings 12–14.

Length of abdomen	57–58·5 mm.
,, wings	46–48 ,,
Pterostigma, forewings	3·75–4 ,,
,, hindwings	4·25–4·5 ,,

I am indebted to Monsieur Bartenef for a ♂ from Lagodechi in Kaketia, the locality whence came de Selys' examples described in Odonates de l'Asie Mineure. Two examples from Belgrade Forest, Constantinople, differ slightly therefrom and *inter se*. In one the transverse frontal line is heavy, in the other it is absent; the dorsal yellow band of segment 2 is if anything broader, but the other bands are rather less extended above than in the Lagodechi ♂; the lunules are distinct up to segment 7.

I am not at all sure that this is the true *C. charpentieri* of Kolenati, although I think it is certainly in the main the

C. charpentieri, de Selys, Odonates de l'Asie Mineure (Ann. Soc. Ent. Belg., xxxi, p. 32, 1887).

Regarding *C. pictus*, Selys, I can come to no definite conclusion. It must remain doubtful without an examination of the ♀ type, which may belong to one of the other recognised species. De Selys made various attempts to find a suitable partner for it, with not very satisfactory results as the following notes show.

1854. *C. pictus*, Syn. Gomph., No. 111, p. 87, ♀ of unknown origin, doubtfully from India.
1856. *C. bidentatus* race *pictus*, Mon. Gomph., p. 340 or 600; ♂ from Broussa; ♀ probably the above.
= 1873, ♂ *C. bidentatus* race *anatolicus*, Syn. Gomph., 3rd Addns., p. 65.
= 1887, ♂ *C. bidentatus* (very probably), Odonates de l'Asie Mineure.
= 1887, ♀ *C. pictus*, Odonates de l'Asie Mineure.
1873. *C. pictus*, Syn. Gomph., 3rd Addns., p. 43, Caucasus, etc.
= 1856, *C. annulatus* race *intermedius*, Mon. Gomph., p. 336 or 596 from Tuscany and Dalmatia.
= 1887, *C. charpentieri*, Odonates de l'Asie Mineure, from Caucasus.
1887. *C. pictus*, Odonates de l'Asie Mineure, represents the original ♀, and ♂♂ of *C. annulatus* race *intermedius* from Tuscany and Dalmatia. But I believe the last-mentioned race = *C. charpentieri* of the Odonates de l'Asie Mineure, as represented by the Caucasus ♂♂, with which, under the name of *C. pictus*, de Selys himself had associated the race *intermedius* of *C. annulatus* in 1873.

Cordulegaster bidentatus, Selys.

The principal differences between this species and the northern form of *C. annulatus* are given by de Selys as follows—

♂. 1st. The black line of the front is a little longer and more constant, slightly upturned at the ends; it is limited by the frontal crest, while in *annulatus* it is placed a little lower.

The excavation of the frons is a little differently constructed; the base of the front before the ocelli is less margined with black.

2nd. The labrum is always markedly margined with black on the

sides, and the anterior margin is equally bordered very lightly with black.

3rd. The little triangle forming the occiput in front is blackish, surmounted with a crest of hairs mixed of blackish and yellowish-grey; this occiput is not vesiculous before or behind; behind it is yellow with a black sunken line.

4th. The yellow line between the two lateral bands is absent or much interrupted (reduced to an upper spot in the female).

5th. Although the median yellow rings may be narrow, those on segments 7–8 constantly reach the ventral suture. The 10th segment has a yellow spot on each side; the 2nd, 3rd and 4th segments have on each side a narrow yellow transverse terminal line, interrupted on the dorsal arête, but this vestige is absent on the following segments.

6th. The superior anal appendages are notably separated from each other and narrower at their base. Besides the internal sub-median tooth which is a little further removed from the base (being almost in the middle) there is towards the first fourth a second external lateral tooth also inclined towards the base, both of these teeth being visible in profile view.

The inferior appendage is about ¾ as long as the superior, longer than broad, a little constricted at the extremity which is not appreciably notched.

7th. The costal nervure is hardly yellow outwardly. The pterostigma is shorter, the large cellule near the membranule is almost always divided into three, rarely four cellules. In *annulatus* it is ordinarily divided into five.

♀. Differs from *annulatus*—

1st. (See above, No. 1.)

2nd. The labrum always broadly bordered with black on all sides, even in front, the virgule reaching the anterior margin and dividing the yellow into two.

4th. (See above, No. 4.)

5th. Colours of abdomen as in the ♂, but differing from *annulatus* in the absence of the yellow spots at the base of the vulvar laminae and by the form of the yellow ring of the 8th segment, much interrupted and consisting of only two yellow lines.

6th. The costal nervure is blackish outwardly, or only finely yellowish between the nodus and pterostigma; the latter shorter and blackish.

	♂	♀
Length of abdomen	50–56 mm.	55 mm.
,, forewing	42–45 ,,	49 ,,
,, hindwing	42–45 ,,	49 ,,

	♂		♀
Pterostigma, forewing . . .	$3\frac{1}{2}$	,,	$3\frac{3}{4}$,,
,, hindwing . . .	$3\frac{3}{4}$–4	,,	4 ,,
Vulvar lamina	—		$9\frac{1}{2}$,,

(Mon. des Gomphines, pp. 599–600.)

The principal characters of *C. bidentatus* are—

Frons yellow with a very strong transverse frontal line; nasus very narrowly margined with blackish at the junction with the rhinarium and also with two blackish spots; rhinarium black; labrum with black margin all round and a strongly marked virgule. Occiput above black with blackish hairs; behind yellowish, not swollen, nearly bisected with a darker line.

Prothorax with interrupted median and posterior line.

Thorax: no humeral dot; lateral intermediate band variable usually much reduced sometimes to a mere point.

Abdomen: 1st segment with an oblique lateral spot not descending to ventral suture; 2nd segment with a narrow dorsal yellow band occupying about $\frac{1}{6}$ of segment, almost isolated from the large anterior lateral yellow spot (this band continued without interruption in ♀); lunules rather large, cut off from lower posterior spot; bands of segments 3 to 8 variable, mostly rather narrow, those of 6, 7 and 8 usually more so than the others, usually all interrupted by the dorsal arête, 7 and 8 at least reaching the ventral suture. Traces of yellow on the anterior part of segment 9. Posterior lunules on 2, 3 and 4.

Actual distribution not quite ascertained. Ris (Süsswasserfauna Deutschlands, Odonata, p. 23) says west and southern Europe. It occurs in Herzegovina and perhaps further east, it may be, even extending to Asia Minor. Calvert (Proc. Acad. Nat. Sciences Philadelphia, 1898, p. 152) records it from Kashmir, but his insect is certainly not the typical form. Examples from Digne (Basses Alpes) are very similar to Swiss specimens, showing no variation corresponding to the southern characters displayed by *C. annulatus* in the same locality. A male from Mostar in Herzegovina is also very similar, the yellow bands being only a little stronger, with traces of yellow even on segment 10. Females from Jablonica have the black margin of the labrum exceedingly broad, so that the virgule practically touches the anterior margin, thus dividing the yellow of the disc in two. De Selys, as mentioned above, says the virgule touches the anterior margin, but this is not always the case.

The following three forms are referred to *C. insignis*, Schneider, provisionally, although they differ from one another very considerably in appearance. Further material from other parts of Asia Minor is much to be desired, and also examples from the European side. *C. insignis* has been recorded from Roumania, but in what form it exists there I do not know.

Cordulegaster insignis, Schneider.

Differs from the meridional form of *annulatus*.

♂. 1st. The front hardly excavated, always yellow without a black line; that of the base before the ocelli almost absent.

2nd. Labrum very lightly margined with brown in front without coloured median virgule.

3rd. The occiput is yellow swollen in front and behind as in *annulatus*, but surmounted by a crest of shorter yellow hairs. The lower whitish-yellow part behind the eyes larger.

4th. The yellow line between the large lateral bands on the thorax reduced to a fine superior line more or less interrupted (as in *bidentatus*). The two yellow bands on the front of the thorax are a little broader inwards.

5th. The abdomen is less thickened before the extremity. The yellow rings of the 3rd, 4th and 5th segments broader, occupying nearly their median half; on the 6th and 7th the yellow ring has the same dimensions as in the preceding, but it is forked behind on the dorsum, and constricted upon the sides also behind, so that it ends in two little yellow points; on the 8th the ring is regular, not constricted upon the sides, straight behind, nearer the base than the posterior end; on the 9th and 10th the lateral yellow spots (one or two on 9th; one on 10th) are larger and better marked.

6th. The appendages are almost of the form of those of *bidentatus*, the superior being separated from their base and provided beneath with two teeth. They are black, brown at the tips; the inferior is as long as broad.

The wings are as in *bidentatus*, the pterostigma being shorter than in *annulatus*, and the large space near the membranule of the hindwings divided into 3 cellules only. 15–18 antenodals in forewings, 13 in hindwings. Costa outwardly strongly margined with yellow.

♀. Differs from that of *annulatus* as follows—

1st. The black line on the summit of the front is very fine and very short; the front less excavated, the black basal line before the ocelli almost absent.

2nd. The upper lip (labrum) finely bordered with blackish even in front (with the median virgule more slender).

3rd. The occiput and back of the eyes (see the male).

4th. Thorax (see the male).

5th. Abdomen (see the male).

6th. The base of the vulvar laminae dark brown (in *annulatus* they are marked each with a yellow spot).

The wings are a little broader, pterostigma shorter, the costa more finely yellowish externally. 18 antenodals in forewings; 13–14 in hindwings.

Compared with *bidentatus*, *insignis* differs from it: the ♂ by the labrum less bordered with black, the median virgule obliterated, the front less excavated, without anterior line; the occiput yellow, globular; the two yellow bands on the front of the thorax broader; the broad yellow bands of the abdomen; the inferior teeth of the appendages a little stronger; the costa more yellowish externally. The ♀ is distinguished by the labrum much less bordered with black; the median virgule smaller; the front less excavated with anterior line very slender and short; its base in front of the ocelli less blackish, the occiput yellow, globular; the two bands in the front of the thorax broader; the yellow rings of the abdomen broad; the costa yellow externally.

	♂	♀
Length of abdomen . . .	57–58 mm.	57–62 mm.
,, forewing	47 ,,	48–51 ,,
,, hindwing . . .	46 ,,	47–49 ,,
Pterostigma, forewing . . .	$3\frac{1}{2}$,,	$3\frac{1}{2}$–4 ,,
,, hindwing . . .	4 ,,	4–5 ,,
Vulvar lamina	—	$7\frac{1}{2}$–8 ,,

Described from two males and two females from Syria and a ♀ from Kellenisch, Asia Minor (Mon. des Gomphines, pp. 603–4).

The following observations are based on material in my own collection. Nearly all the specimens have been slightly altered by pressure, and I am unable to confirm with absolute certainty the above statement that the abdomen is less thickened than in *annulatus*, but it is probably correct. Otherwise the specimens are nearly all in very good condition.

I. A ♂ from Asia Minor without more definite locality agrees fairly well with the above description. It may be from the Taurus Mountains whence Prof. Manissadjian (from whom the whole material of this species was received)

sent me a few dragon-flies. In this example, on 1st segment of abdomen there is a broad oblique lateral band not reaching quite to the ventral suture. The yellow dorsal band of 2nd segment is not broad but is continuous with the anterior lateral yellow marking; the black dorsal marking of this segment with a prominent middle lobe; hind lunules well marked, broadly disconnected with the lower lateral posterior marking, which is small; lateral marking on segment 9 basal only; none on segment 10.

Antenodals: forewing 14; hindwing 11.

II. Race **amasinus**, nov.

From Amasia there is a series of 4 males in which the yellow dorsal markings are much more highly developed, being present even on 1st segment in a limited degree. In this segment the lateral markings are variable, in one case at least nearly reaching the ventral suture. Lunules on segments 2, 3 and 4 sometimes not interrupted by the dorsal arête, and may be represented on all the other segments to the 8th or 9th; 9th and 10th showing both anterior and posterior lateral markings. The nasus is entirely yellow.

In two females presumably from the same locality, there is a trace of the anterior line on the frons, but the virgule on the labrum, though distinctly present, is entirely unicolorous with the disc. The nasus is very slightly marked with brownish on the anterior margin.

Antenodals: ♂, forewing 16–17; hindwing 11–12; ♀, forewing 15–16; hindwing 12.

De Selys in his notes on *C. insignis* does not refer to the colours of the prothorax. It should be here noted that in form I the posterior yellow line is broadly interrupted and short; there is also an interrupted median yellow line, with two yellow dots between it and the posterior margin; the anterior margin is also yellow. In II (*amasinus*) the posterior yellow line is interrupted but much longer, and the other yellow markings on the prothorax are well defined.

III. Race **nobilis**, nov.

At Van, in the extreme east of Asia Minor, near the Persian frontier, there is a still further increase in the yellow markings at the expense of the black ground-colour, if indeed these examples (2 ♂♂, 2 ♀♀) belong to *C. insignis*.

Oddly enough there is no trace of yellow markings on the dorsum of 1st segment, although the segment is rather lighter in colour than in No. I. This is a very beautiful and interesting form. Dr. F. F. Laidlaw tells me that in the collection of the Indian Museum there are two specimens ♂ and ♀ labelled in de Selys' own handwriting, "*Cordulegaster nobilis*," and dated "May '71, Shiraz," Persia; the ♂ he states is indistinguishable from the ♂ from Van as represented in my fig. 11, which I sent to Dr. Laidlaw for inspection. No description of these appears to have been published.

The following characters may be mentioned—

Prothorax: the posterior band is not completely interrupted in the middle, although a narrow black wedge is partly driven into it; the lateral angles are yellow and the posterior and the interrupted median line are practically confluent therewith. Yellow abdominal bands much extended, the greater part of most of the segments yellow; for these, see fig. 11; these yellow markings are continued more narrowly on the sides cephalad, and up to the 8th reach the ventral suture in the ♂ and nearly so in the ♀.

Antenodals: ♂, forewings, 14–15; hindwings, 11–12; ♀, forewings 15–16; hindwings, 11–12.

The following are approximate measurements—

	Locality?	Amasia.		Van.	
	♂	♂	♀	♂	♀
Length of abdomen	50 mm.	52·5–53·5 mm.	60–63 mm.	50–52 mm.	60 mm.
,, wing	41·5 mm.	43–44·5 mm.	48–50 mm.	41·5–43·5 mm.	46–47·5 mm.
Pterostigma, forewing	3·5 mm.	3·75 mm.	4 mm.	3·5–4 mm.	4 mm.
,, hindwing	3·75 mm.	4·25 mm.	4·5 mm.	4–4·5 mm.	4·5–5 mm.
Vulvar lamina	—	—	8–8·5 mm.	—	8 mm.

The males would therefore appear to be smaller than those from Syria.

The last species to be noticed is closely allied to *C. bidentatus* and *insignis*, but it has been treated as an independent species. It differs from *C. insignis* in the condition of the labrum, which has a distinct black median virgule.

Cordulegaster coronatus, n. sp.

♂. Frons yellow without black frontal marking; nasus yellow with two black points; rhinarium black; labrum yellow with very narrow border black but becoming brownish on anterior margin, usually

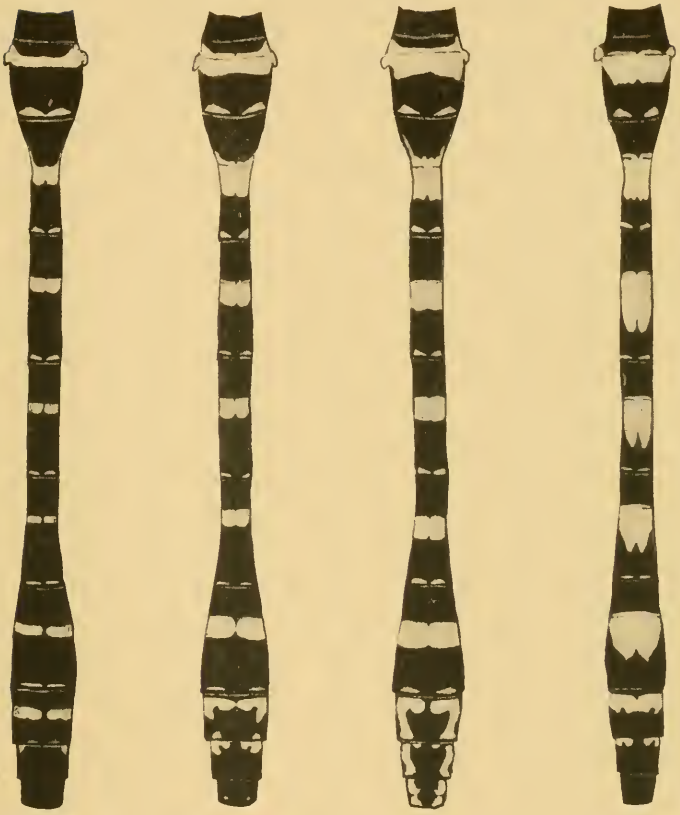
with a strongly marked virgule; mandibles externally yellow; genae black; occiput yellow with yellowish hairs; labium yellowish. Vertex black obscurely marked with yellowish, the black hardly encroaching on the frons and continued very narrowly downwards alongside the eyes. Occiput hardly swollen; behind yellow divided to the extent of about half by a blackish virgule. Behind the eyes whitish with a broad black border.

Prothorax black bordered with yellow in front and behind, with two median yellow dots and a broken median line which becomes confluent with the posterior yellow border.

Thorax in front with long silky hairs; black marked with yellow thus: two large cuneiform antehumeral bands in front enclosing a large black triangle, and two broad oblique lateral bands of almost equal breadth; between these an interrupted line broken up into four, the large upper part somewhat wedge-shaped, followed by a minute elongate spot and a spot on each side of the stigma; no humeral dot visible; a yellow spot at the wing attachments above; a yellow inter-alar spot, double between the hindwings. Coxae yellowish, sternum yellow with fuscescent markings.

Abdomen cylindrical, constricted after 2nd segment, and gradually increasing in breadth to 7th and 8th, the remaining segments again narrower. Basal segment slightly brownish with traces of a yellow spot at the extreme base. Abdomen otherwise black and yellow. 1st segment with yellow lateral markings both anterior and posterior variable in extent; 2nd mostly yellow dorsally with a black basal band followed by two fine black dashes, a black, sometimes isolated, usually roughly oval dorsal spot; posterior margin finely black; segments 3, 4, 5, 6 and 7 with large dorsal yellow markings partly divided by the dorsal arête, on 3 occupying about $\frac{2}{3}$ of the segment, on 4 the spots occupying about $\frac{1}{2}$ of segment; on 5, 6 and 7 less than $\frac{1}{2}$, each of these five segments with posterior yellow lunules or bands. Segments 8, 9 and 10 mostly yellow with large dorsal black patches. Margins of segments ventrally finely lined with yellow along the ventral suture.

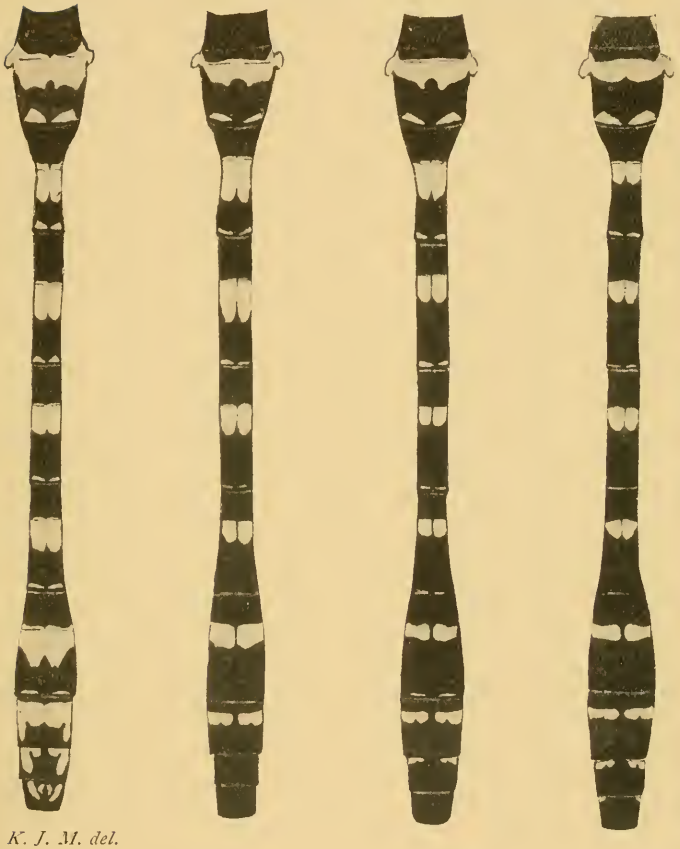
Appendages black. Superior about the length of last segment, separated at the base. Outer margin in dorsal view nearly straight, tip acute: inner margin about $\frac{2}{3}$ from base forming a tooth from which to the base the breadth is less; in profile view broader at the base where there is a large tooth with apex directed cephalad, and the appendage tapers slightly to the acute apex which is somewhat upturned. In profile view the median tooth is smaller than the other with its apex pointed in the same direction. Inferior appendage rather over half as long as the superior, broad with nearly parallel sides, slightly emarginated at the upturned apex.



K. J. M. del.

1 2 A 3 B 4

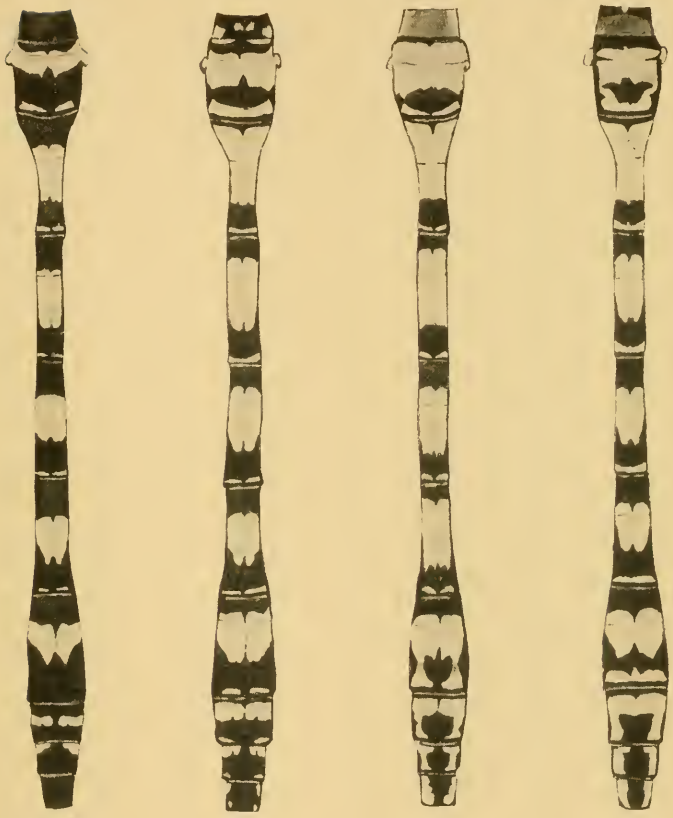
PALAEARCTIC SPECIES OF CORDULEGASTER.



K. J. M. del.

5 6 7 8

PALAEARCTIC SPECIES OF CORDULEGASTER.



K. J. M. del.

9 10 11 12

PALAEARCTIC SPECIES OF CORDULEGASTER.

Photo, W. E. Evans.

13

CORDULEGASTER CORONATUS, n. sp.

♀. Similar (single example somewhat discoloured). Posterior dorsal spot of 2nd segment isolated (almost as in fig. 12); yellow on segments 2, 3 and 4 occupying more than ½ of each segment, on 5, 6 and 7 about ½, 8 black (discoloured?), 9 and 10 mostly yellow, dorsum of 9 broadly marked with black, 10 with two irregular elongate blackish markings broad at the base and becoming lighter towards the hind margin where they terminate in a definite black dot. Costa yellow externally in both sexes. Antenodals: ♂, forewings 13–16; hindwings, 10–12; ♀, forewings, 14–15; hindwings, 11.

	♂	♀
Length of abdomen	53–55 mm.	59·5 mm.
„ wing	43–45 „	48·5 „
Pterostigma, forewing . . .	3·5 „	4 „
„ hindwing . . .	4–4·5 „	5 „
Vulvar lamina	— „	7 „

The dorsal marking on 2nd segment in fig. 12 represents an extreme form; it is usually more oval in outline but frequently showing little wing-like lateral projections. The dorsal markings generally show some variability in their extent in different specimens.

7 ♂♂, 1 ♀, Kokand, Fergana.

I am unable to give serviceable figures of the appendages of the various species, but think the diagrams showing the distribution of the black and yellow markings on the abdomen may be of use. These are not drawn to scale, but the measurements of the abdomen are given for each species.

Other species of the genus have been noticed from the more eastern parts of the region, but of these I possess no material.

It may be well to explain the difference in the references here given to the pages of the Monographie des Gomphines when compared with those given in Kirby's Catalogue. Mr. Kirby and other authors, including de Selys himself, appear to have made use of "separates" of the Monographie. There fall to be added to Kirby's figures, 260 pages, to make them correspond with those here quoted. The inaccuracy of the date quoted by Kirby has already been pointed out by Calvert (Biol. Centr.-Amer., Neuropt., Odonata, p. 148, 1905). De Selys himself, however, had already stated in the introduction to the Additions au Synopsis des Gomphines (Bull. de l'Academie Royale de Belgique (2), vii. 1859) that the Monographie was only published in 1858.

It may also be pointed out that in the Synopsis des Gomphines (1854) and in the Monographie, the characters of the two groups, as far as the teeth of the superior appendages are concerned, have been transposed. Correction of this error is made in the Secondes Additions au Synopsis des Gomphines (Bull. de l'Acad. Royale de Belgique (2), xxviii. 1869).

Explanation of Plates XXXIV–XXXVII.

PLATE XXXIV

Fig. 1. *C. annulatus*, New Forest.
2. ,, ,, *immaculifrons*, Digne, form A.
3. ,, ,, ,, ,, ,, B.
4. ,, ,, *princeps*, Tiflis.

PLATE XXXV

5. *C. annulatus algiricus*, Sebdou, Algeria.
6. ,, *charpentieri*, Caucasus.
7. ,, ,, Constantinople.
8. ,, *bidentatus*, Mostar.

PLATE XXXVI

9. *C. insignis*, loc. ?
10. ,, ,, *amasinus*, Amasia.
11. ,, ,, *nobilis*, Van.
12. ,, *coronatus*, Kokand, Fergana.

PLATE XXXVII

13. *C. coronatus*, Kokand, Fergana, from another specimen (photo : W. E. Evans).

XI. *What the larva of* Lycaena arion *does during its last instar.* By T. A. Chapman, M.D., F.Z.S.

[Read June 2nd, 1915.]

Plates XXXVIII—XLVI.

For many years the life-history of *Lycaena arion* has been a puzzle, and has much interested and exercised those of us who find the habits of butterflies, and especially of British butterflies in their earlier stages, to present absorbing biological matter worthy of our best attention.

I am absolved from traversing the whole ground, *ab initio*, by the valuable résumé of all that was known up to last year, and references to where the recorded facts may be found, that was given us by the Rev. Geo. Wheeler in Tutt's "British Lepidoptera," vol. xi. p. 331 *et seq.*

It may be desirable, however, so far to recapitulate as may make it clear in what the puzzle and mystery consisted.

The majority of European Blue butterflies hibernate as larvae in their third instar, having in all five instars. Others hibernate as full-grown and full-fed larvae; others as pupae, and some as eggs. Each of these different habits of, or rather stages for, hibernation is adopted by more than one species.

L. arion differs from all these, and agrees with no other species in its method of passing the winter.

It is not, I believe, alone in having only four larval instars, but to have five is, one may say, the rule in these butterflies.

Living on thyme, chiefly the flowers, it at length reaches the fourth, which is its last, instar some time in or about August, and then goes into hibernation. When it does so, it is so small that until Mr. Frohawk (Entom., vol. xxxix. p. 145) showed that it was still in the same instar when full grown in the spring, one could not avoid supposing that it would have at least one more moult in the spring, and that probably one had made some error in

taking it to be in the fourth instar, and that it must be in the normal hibernating instar, the third adopted by so many other species.

Mr. Frohawk's discovery solved a most remarkable problem, that our previous ignorance practically prevented our realising as existing, viz. How many more instars had the larva when going into hibernation to pass through to become full grown? and the startling answer was, None; it was already in its last instar.

It further compelled us to regard as even more difficult and insistent, the question of how this minute larva, one-eighth of an inch long, grew to its mature dimensions of well over half an inch long and correspondingly thick; in fact, a larva suitable to produce a butterfly as large as *L. arion*.

Did it feed up in autumn, in winter or in spring, or in two or all of these seasons? What was its food?

That it was somehow associated with ants seemed the most acceptable basis for a hypothesis, but still there was something to be said in favour of a vegetable diet. These questions have been discussed by various people in various journals, etc., at considerable length, with the object of thinking out the best way of investigating the problem.

It would not be profitable to discuss in detail the various ideas suggested, since it happens that by a combination of perseverance, and good luck almost comparable with Mr. Frohawk's, I am able to give, not by any means the whole history, but certainly its chief fact and keynote.

On May 14, 1915, on pulling up plants over a nest of *Myrmica scabrinodis* var. *sabuleti* and disturbing the soil at a point close to overhanging heather, etc., a larva of *L. arion* was found; it seemed to be amongst loose earth that the ants had worked over, and if not actually in the ants' nest was within less than an inch of ground actually occupied by the ants.

Unfortunately in the rough process necessary in disturbing plants and soil the larva suffered an injury.

Its length was 11·0 mm. and thickness about 3·0 mm. Its colour a pale earthy flesh-colour, no trace of green anywhere, and the impression it gave was, that it must be a concealed feeder. Mr. Frohawk, as well as I, considered that it was by no means full grown. There were visible some dark contents of the posterior extremity of the alimentary canal, shining through the ventral surface,

elsewhere the larva was too opaque to show whether there was anything of food material in its interior.

The larva was found near the surface, but precisely where in relation to the ants was not ascertained, the earth being broken up before the larva was seen; but it was certainly not in any permanent tunnel or chamber of the ants' nest, but more probably amongst the looser surface material, brought up by the ants and not yet consolidated, and amongst which, in weakly constructed chambers, the ants dispose of their larvae temporarily on fine warm days.

The ant with which this larva was associated was *Myrmica scabrinodis* var. *sabuleti*, for which name I am indebted to Mr. Donisthorpe, who gives me, also, the following names as those of the ants I sent him of species which were more or less frequent or common in the locality. *Donisthorpea* (*Lasius*) *aliena*, *D. flava*, *Tetramorium caespitum* and *Myrmica scabrinodis*. Whether *L. arion* larva occurs with some or all of these also, remains to be seen. *D. flava* has always been supposed to be its host, if it had an ant host, and this is very probably correct, though the grounds for the belief are that the thyme on which the butterflies lay is often that growing on the hills of *D. flava*, and that the larvae and pupae found by Mr. Frohawk were apparently close to or on such a hillock. Nevertheless, these ants are so numerous and their nests so close to each other and almost, one might say, mixed together, that, unless found actually living with the ants, and not merely on or near their nests, one cannot feel at all sure whether their supposed host is really one. On the other hand, *D. flava* makes chambers and galleries, that look very suitable for *L. arion* to inhabit, more extensive, definite and formal than any of the other ants noticed, and yet I and others have dug up and closely examined dozens of nests of *D. flava*, without meeting with any larva of *L. arion* in the actual nest.

The hope of discovering what the larva would eat was unavailing in view of the injury to the larva; there remained, however, the possibility of learning what it had eaten by examining the contents of the alimentary canal. This, fortunately, proved to be a very satisfactory line of investigation, and enabled its recent history, as regards its food material, to be easily determined.

The dark mass seen through the lower surface was the

posterior portion of the gut full of a dark material. It measured 3·0 mm. in length and over 0·5 mm. in thickness. It was rather hard and solid and so remains, as I have not broken it up, but mounted in Farrant's medium its structure is fairly evident. Further forwards in the gut were also portions of contents. These were soft and easily pressed flat on a slide.

The posterior portion of the dark mass is rather shorter and more slender than the forward portion. It presents a quantity of granular material in layers of darker and lighter appearance. It might, though I hardly expect it, yield some structural material from which some information would result were it broken up; for the present, however, I have not done so. The forward portion seems to consist of a mass of minute hairs, of fairly uniform size and structure.

The less dense material found further forwards in the gut presents a number of identical hairs, but also some small triangular chitinous bodies very like mandibles of some insect.

Mr. Donisthorpe having told me that the ant with which I found the larva was *Myrmica scabrinodis* var. *sabulcti*, brought to my recollection that last year I had examined and mounted specimens of the larva of *Myrmica scabrinodis*. These came in, now, most usefully, and, to make a long story short, a comparison of the larval skin of *Myrmica scabrinodis*, and of the contents of the alimentary canal of my example of the larva of *L. arion*, showed that the hairs in the *arion* agreed precisely with those of the full-grown larva of *M. scabrinodis*, and that the chitinous triangles agreed exactly with the mandibles of the same larva.

Nothing of a vegetable character was found amongst these contents, and it could not be doubted that the *L. arion* larva had eaten many larvae of *M. scabrinodis* and nothing else for a long time.

The dark mass of *dejecta* in the lower gut suggests several questions. First, perhaps, it seems highly probable that the larva of *L. arion* in its last instar behaves as do the larvae of many bees and wasps, various parasites, such as *Meloecus* and other insects, that live on material that is practically all digestible, and contains very little effete material; that is, it does not, until it has completed its growth, evacuate any of the contents of the gut, but allows

all the undigested material and effete matters to accumulate in the rectum during the whole period of growth, to be ejected when the period for pupation approaches. In the case of some ichneumons it is, if I recollect aright, voided by the imago itself.

This hypothesis is in itself a very remarkable one as applicable to the larva of a butterfly, but it seems difficult in any other way to account for the mass of hairs of *scabrinodis* larvae which represent, obviously, a number of individuals, that must have taken a considerable time in consumption, very much beyond that, that butterfly larvae usually pass between each act of defecation. The mass also occupies its position in a way very unlike material passed along the canal in the ordinary regular manner.

If we adopt this hypothesis, then the division of this mass into two portions raises further questions.

The lower and therefore earlier portion gives no indication of what food it represents, the other later portion represents many larvae of *M. scabrinodis*, all apparently in their last instar.

Does the first portion represent some different diet? it certainly does not represent full-grown larvae of the ant. Does it result from the earlier food being *ova* or young larvae of the ant that were more thoroughly digestible, and so left no recognisable detritus? Was the earlier diet a vegetable one, as some of Mr. Frohawk's observations suggest? Or is some other explanation available? as to which one might speculate, but not very profitably, on several.

As this larva affords me a skin at a period when it is not full grown but still not very far from it, it may be worth while to compare it with the little larva that disappears in the autumn, as the material for doing this which I used in assisting Mr. Wheeler's history of the species, though perfectly satisfactory and conclusive to myself and probably to most other people, did not, after all, provide any photographs otherwise than rather fragmentary ones, so that one or two from this specimen are probably useful.

These photographs also confirm a point already alluded to more than once, viz. that this specimen was not full grown. Comparing with the photographs in Tutt's "Brit. Lep." of Mr. Rayward's larva, it will be seen that the hair bases are still much closer together than they become in

the full-grown larva. It may also be noticed that the hair bases are very commonly surrounded by an area free from obvious skin-points, making each look like the centre of a circle.

The small size of the head for so large a larva is almost ridiculous, notwithstanding that the larva is not full grown.

The honey-gland, so conspicuous in the autumn larva, owing to its comparatively large size, remains of the same size, and looks extremely small (as compared with other Plebeiid larvae) owing to the expansion of the rest of the larva. One is inclined to regard it as still functional, the four circles seen at the bottom of the hollow being very distinct. Possibly, however, these would look just the same if the function were in abeyance, although they are certainly a feature of all functional honey-glands I have examined.

That *arion* is carnivorous in its last larval instar, not only gives us a Lycaenid of this character in the European fauna, which we were before without, though other quarters of the globe possess them, but also gives the very remarkable habit of the food being vegetable in the early stages, animal afterwards. I need not dilate on the other curious points in the life-history, but must note that the other European Lycaenines, its nearest relatives, *melanops*, *cyllarus*, *euphemus*, *arcas* and *alcon*, appear to have more or less ordinary Lycaenid habits.

The photographs presented are by Mr. A. E. Tonge.

They show—

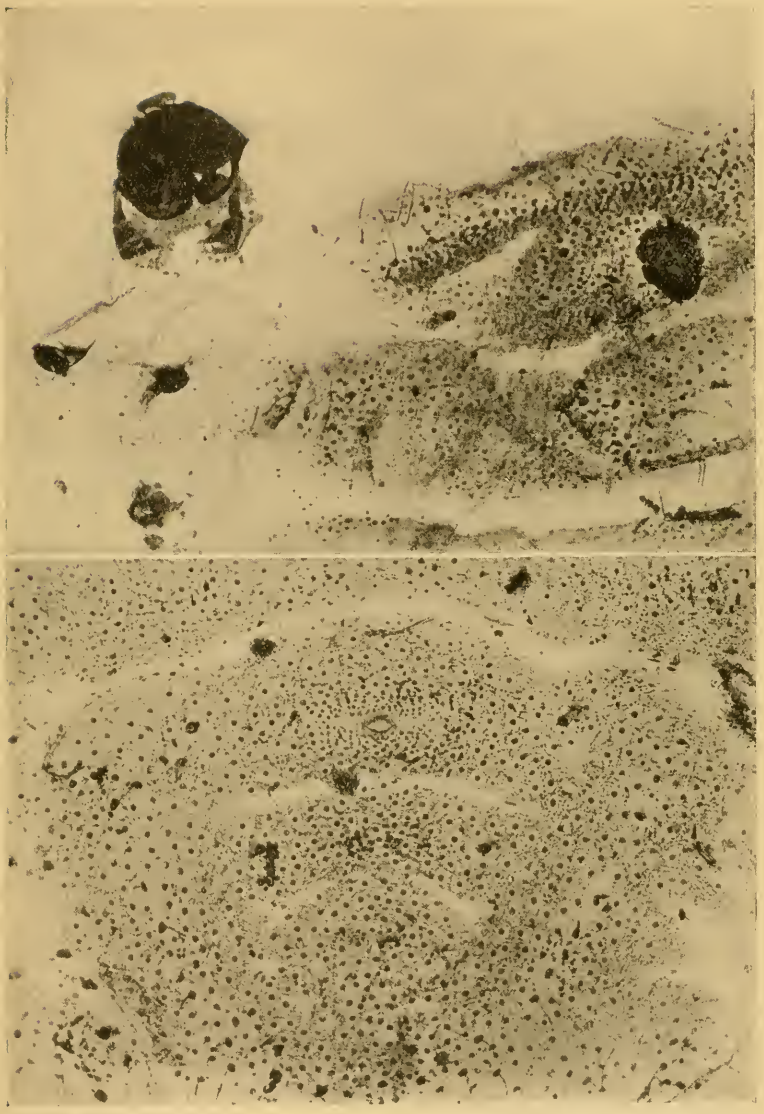
1st. The skin of the larva found May 14, 1915 (injured in capture) × 7. It shows the difficulty of clearing away the dirt, that was one reason why the preparations from the larva given me by Mr. Rayward were not too satisfactory. It suggests that the larva did not pass its life in chambers and galleries of the ant, but amongst loose earth, etc. The comparatively small size of the head may be remarked as well as of the honey-gland; these are perhaps more noticeable in—

2nd. Portion of front of larva and of honey-gland region × 25. These three photographs may be compared with those I gave in Tutt's "Brit. Lep.," making proper allowance for different magnifications.

3rd. Portion of contents of alimentary canal forward of black mass, showing mandibles and hairs of ant larvae × 55. The preparation is not one that lends itself well to

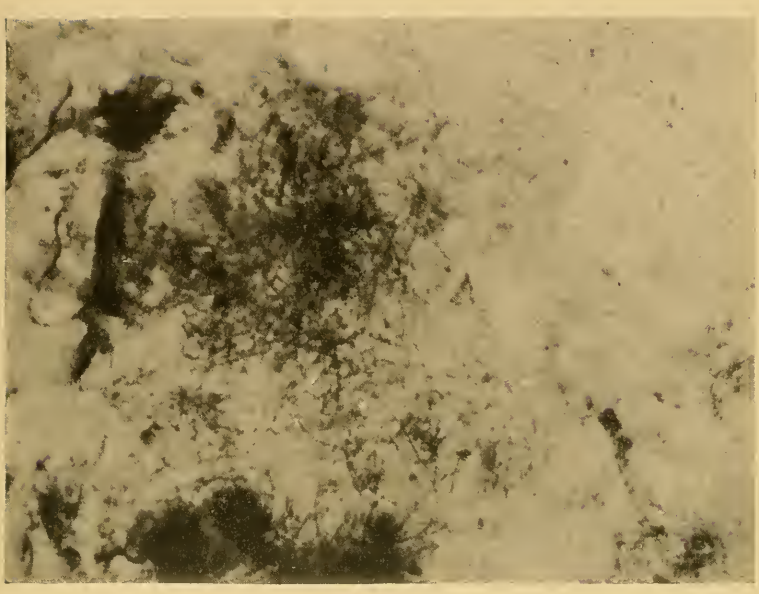
Photo, A. E. Tonge. *Andre, Sleigh & Anglo, Ltd.*

Skin of the Larva of ***arion*** (found on May 14) × 7.



Photo, A. E. Tonge. *Andre, Sleigh & Anglo, Ltd.*

1. Head and prothorax. 2. Seventh and following abdominal segments of the larva of *arion* (May 14) × 25.



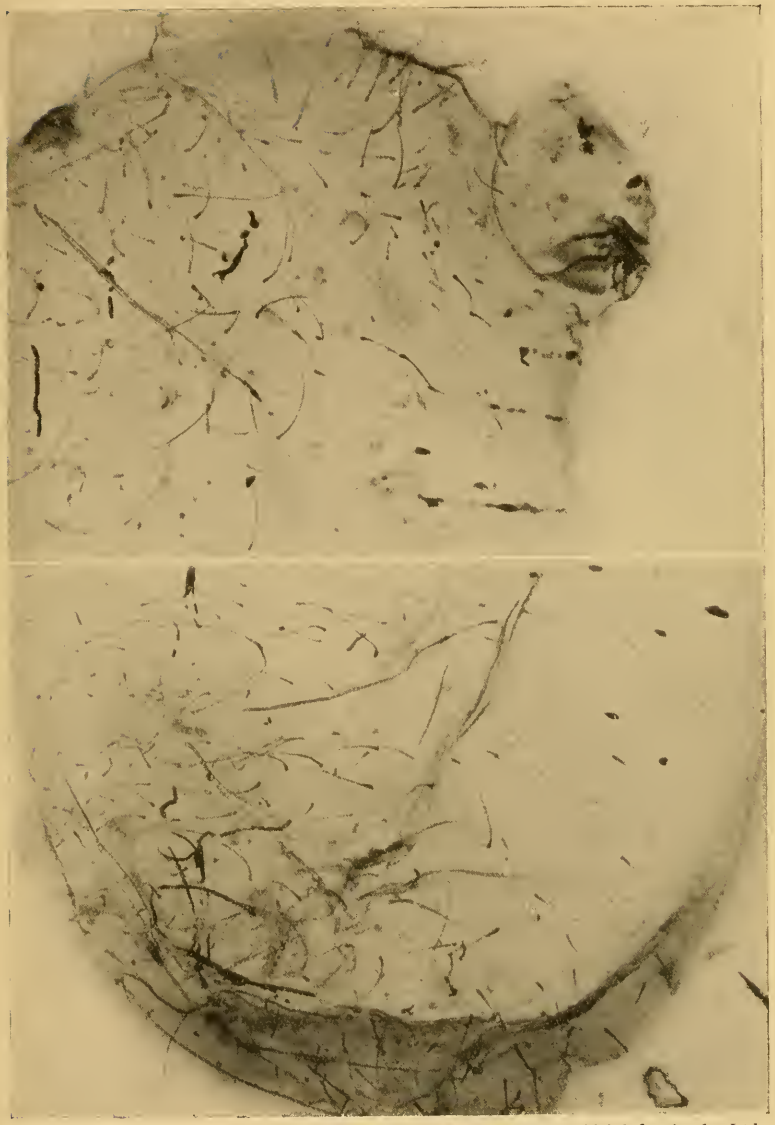
1

2

Photo, A. E. Tonge. *Andre, Sleigh & Anglo, Ltd.*

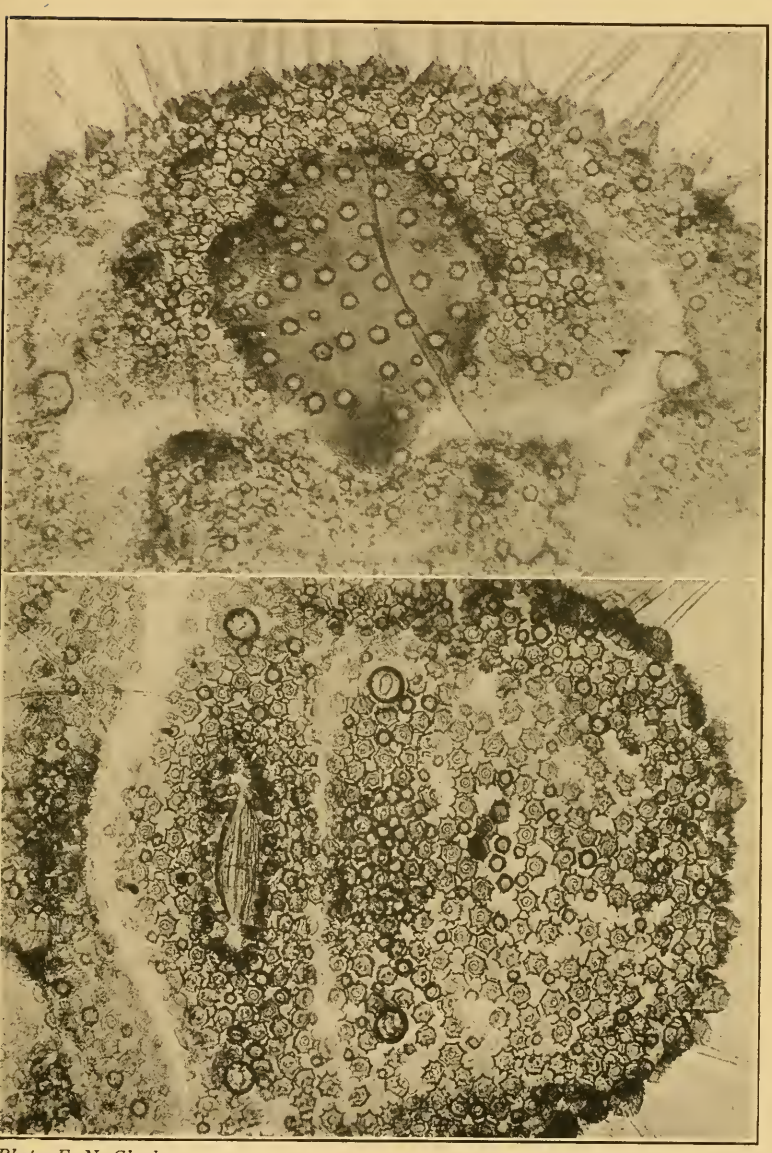
Some contents of Alimentary Canal of Larva (May 14, 1915).

Fig. 1. Forward part of canal × 55. A larval jaw of *M. scabrinodis* just above centre of photograph.
Fig. 2. Diagram of contents of hinder part of canal × 15.



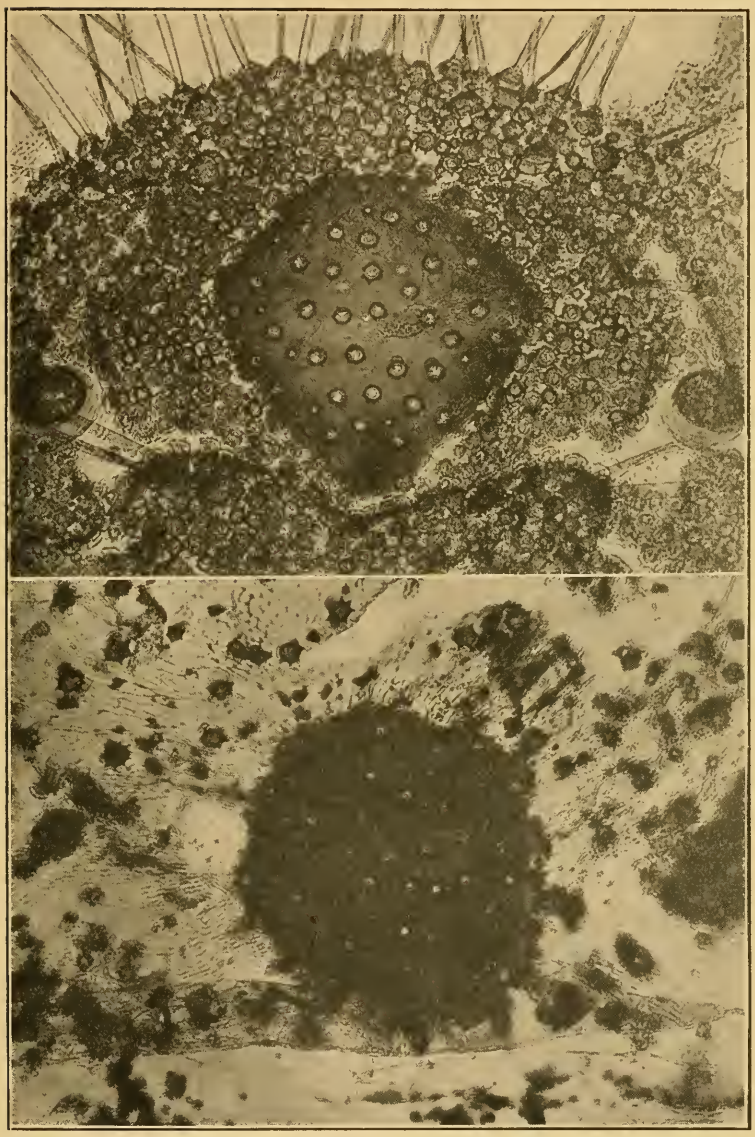
Photo, A. E. Tonge. *Andre, Sleigh & Anglo, Ltd.*

Anterior and Posterior portions of Larval Skin of ***M. scabrinodis*** × 55, to show Jaws and Hairs.



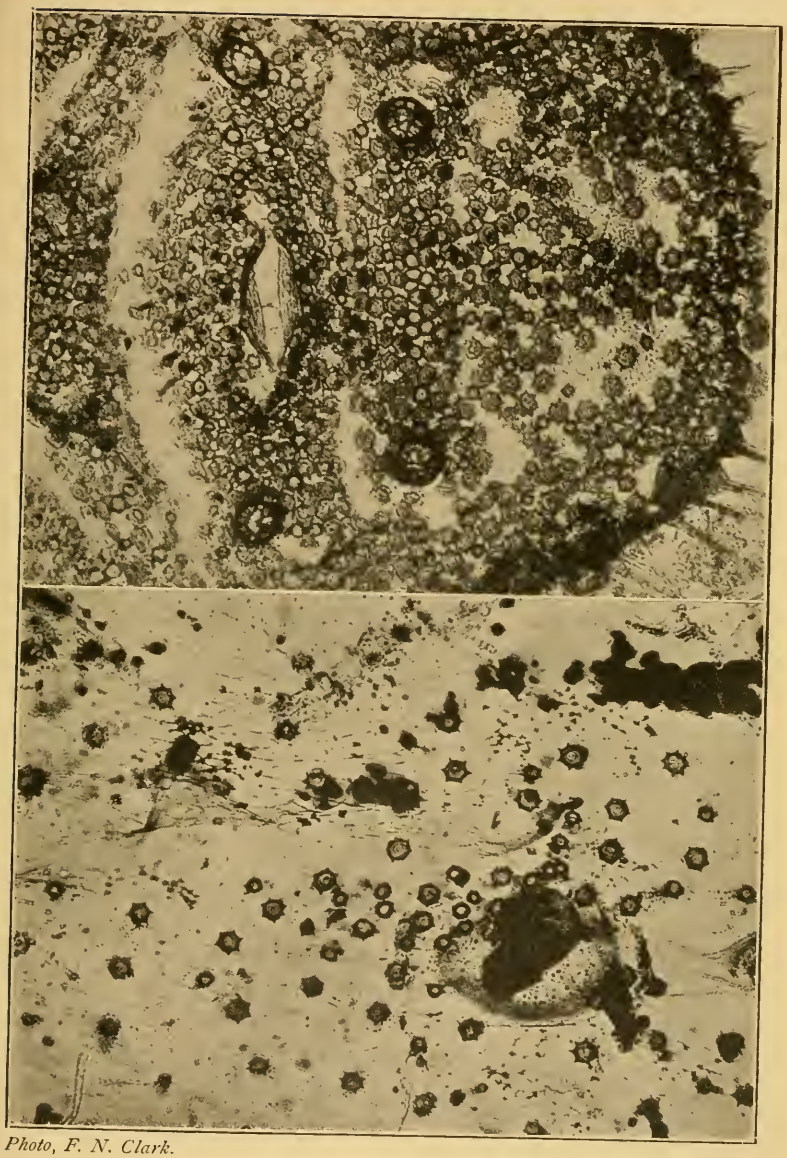
Photo, F. N. Clark.

Larva on leaving Thyme. Prothorax and last four Abdominal Segments with Honey Gland × 100.



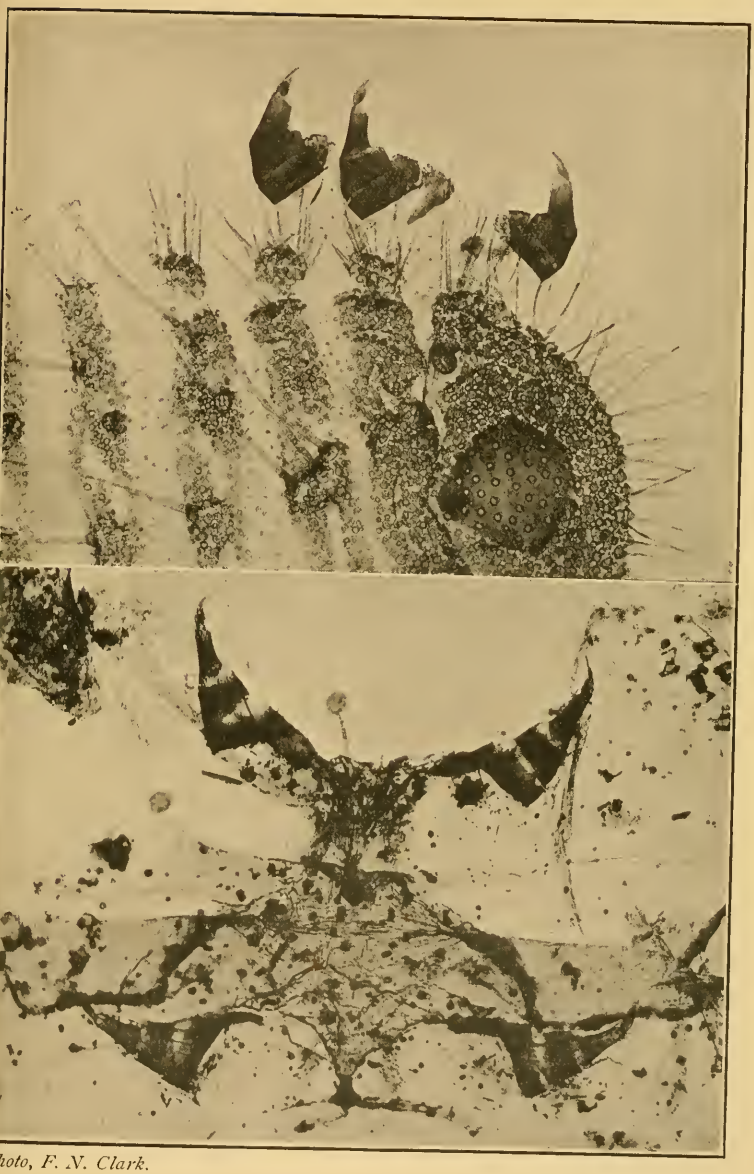
Photo, F. N. Clark.

Prothoracic Plate × 100, on leaving thyme, and when full-grown (the lower figure is turned 30° to the left).



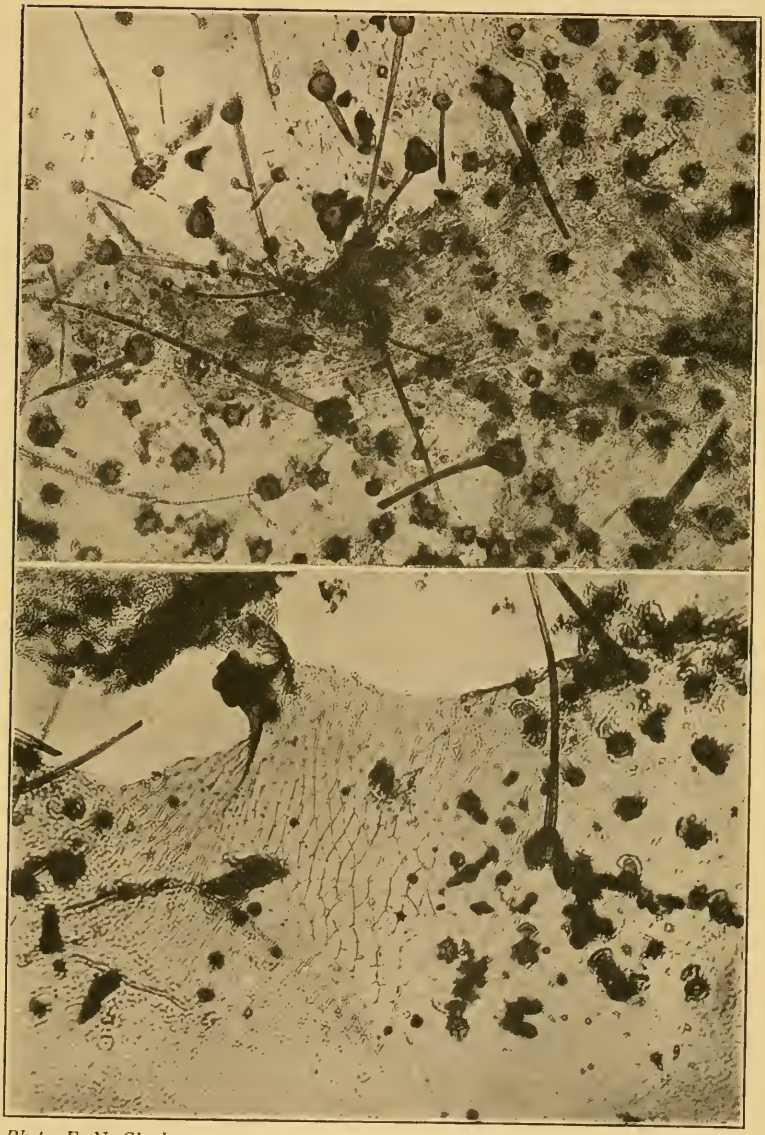
Photo, F. N. Clark.

Last four segments on leaving thyme, and portion of same region of full-grown Larva × 100.



Photo, F. N. Clark.

Comparison of Legs on leaving thyme and when full-grown, the latter a little more extended × 45.



Photo, F. N. Clark.

Two portions of Prothorax of full-grown Larva × 100, showing spreading of hairs and skin structure.

XII. *Observations completing an outline of the Life History of* Lycaena arion, *L.* By T. A. Chapman, M.D., F.Z.S.

[Read October 6th, 1915.]

Plates XLVII–XLIX.

On June 2nd, 1915, I laid before the Society an account of a small but important discovery as to the habit and food of the larva of *Lycaena arion*, L., as it was attaining its full growth in the spring. This showed that at this stage it lived in or near the nest of *Myrmica scabrinodis*, Nyl., and fed on the larvae of that ant, and pointed to the larva not clearing the *primae viae* in the usual lepidopterous manner.

I was of course very desirous of learning something of the autumn habits of the larva, from the point at which all previous efforts to trace its proceedings had, in spite of prolonged investigation by many observers, quite failed. With the light thrown on the matter by my spring results, this seemed more hopeful, since there was now for guidance the fact that the larva associated with ants and preyed on their larvae, and whatever number of species of ant it might thus parasitise, it was at least certain that *Myrmica scabrinodis* was one of them.

By the kindness of our President and Mr. Frohawk, I obtained some eggs of *L. arion* in July, and in August had reared some larvae to the critical stage. I am also much indebted to Mr. Donisthorpe for advice and assistance in regard to ants, and especially for two observation nests of *Myrmica scabrinodis*, one of the type and one of the var. *sabuleti*.

Among other observations I made some very imperfect ones in regard to *Donisthorpea flava*, De Geer. I have not, either now or in previous years, met with any real evidence of any sort to show that the larva of *L. arion* can live in the nest of *D. flava*. Nor, on the contrary, is it surprising, especially since any accurate knowledge is so recent, in view of the difficulty of proving a negative, that there is no proof that it cannot live with *D. flava*. But it remains as a weighty circumstance that all the exertions that have

been made, and to which I have contributed my share, to find the larva with *D. flava* have met with no scintilla of success, pointing very strongly to the larva never in fact associating with that ant. The hills of *D. flava* are very often covered with thyme, on which, as on other plants of thyme, the ♀♀ of *L. arion* impartially lay their eggs. This, no doubt, is why *D. flava* has always been supposed to be the ant, if there was an ant, affected by *L. arion*. It is, of course, the fact that nests of *M. scabrinodis* are common, often as abundant as those of *D. flava*, but much less conspicuous, and in more than one instance I can confirm the remark of Frederick Smith, who says in regard to *Donisthorpea* (*Formica*) *flava* (Brit. Mus. Cat. Fossorial *Hymenoptera, Formicidae*, and *Vespidae*, p. 16, 1858): "This species is sometimes found occupying one side of a hillock, whilst *Myrmica scabrinodis* appropriates the other."

I append the notes of Mr. Donisthorpe's observations and my own; it may be useful before giving them to shortly state what they demonstrate.

When the *arion* larva leaves the thyme and sets out on its travels there is a vague indication that if it comes across the trail of *M. scabrinodis*, that is, one of its beaten tracks, it accepts it as a road to be taken. At length it meets or is found by an ant of this species (or some other). It may be, however, that this first and other ants pay little attention to it; at length, however, one does. The ant examines it and proceeds much as ants do when milking Lycaenid larvae; it goes further than this, it leaves it and circles round it, returns, again milks the larva, and may do this several times. At length, by some agreement, apparently on some signal given by the ant, the larva assumes a most extraordinary form, swelling up the thoracic segments at the expense of the others; such a form as I have seen no other larva assume. The ant then seizes it behind the thorax and carries it into her nest. Here the larva associates with the ants, but receives little or no notice from them, is always at a place where the ants thickly surround a mass of brood, and on this brood the *L. arion* feeds and grows rapidly to a length of 8 to 10 mm. —so rapidly, that it would be full-grown before November, if it went on; as it is not full-grown in April, it follows that it takes a winter rest about half-grown.

My notes with remarks they suggest are as follows, but I place first Mr. Donisthorpe's.

The record, of the two larvae of *L. arion* placed in an observation nest of *M. scabrinodis* of Mr. Donisthorpe's, on August 4th, and of two others, given by him at intervals, as follows :—

" August 9th.—The larva we put into the nest got out in the night, but I put it back and blocked it in with sand, as also the other. The latter was dragged in by an ant, but not hurt, and many ants gathered round it. To-day I can see only one larva, but it is in the midst of the ants and their brood, and is *distinctly* larger. There are ants' eggs and young larvae in the nest, I find, besides older larvae and pupae.

" August 11th.—The one larva is still in the large chamber, and is usually covered with the ants and their brood; when I move the cover, and all the ants run into other galleries and parts of the nest, it becomes exposed and moves slowly; it is again larger to-day. I cannot see the other *arion* larva anywhere, but there are many places to hide in in the earth nest."

On August 13th Mr. Donisthorpe received two more larva, perhaps not so fresh as might be desirable; he notes that he introduced one larva into a *scabrinodis* nest, not much attention was paid to it. It crawled about in the light-chamber and climbed up the side; still on the wall at one o'clock.

Another nest of *scabrinodis* on same date had the other larva introduced into light-chamber. Great attention paid by one ☿ (larva swells in front, as described by Dr. Chapman). One o'clock, larva still attended by the one ☿ in same place.

August 16th he says : " To-day both are dead, the one looks as if the ants had killed it and sucked the body dry; all went well at first, and they lived in the colonies for two days."

Later he sent me the dead larvae, saying : " The one I think died, it never went out of the first (light, dry) chamber; very little attention was paid to it. The other I believe was killed and sucked dry, at least it looks like it. It was taken a great deal of notice of; yesterday it was dead in the last (dark, damp) chamber."

Mr. Donisthorpe sent me these dead larvae.

The appearance of the larvae, dried up as they were, certainly bore out Mr. Donisthorpe's conclusions; but on soaking and macerating them, they both appeared to have

the skin equally intact. The probable cause of the difference of appearance is that the larvae both died from exhaustion, from not reaching the ants' nests (and brood) soon enough; the one that died outside the nest, *i. e.* in (light, dry) chamber, which the ants treat as not in the nest, looking there for food and depositing their debris, was never meddled with by the ants; the other, rather less exhausted, did reach the nest, but too late, and, dying in the nest, was examined and moved about by the ants, and being limp and inelastic, preserved the impressions of their jaws, without having been injured by them. The point is interesting, as bearing on the question as to whether the *M. scabrinodis* may be inimical to the larvae of *arion* in any particular circumstances.

" August 16th.—The old one in the earth nest is well and larger and in usual spot.

" August 18th.—Larva still larger, in other side of big chamber.

" August 19th.—Yesterday the larva was in the large chamber in the earth nest, and was considerably larger. I measured it by putting my micro. mm. slide on the glass above it, and it was a little over 5 mm., and broad in proportion. To-day I can't see or find it; it is not in the box outside the nest, as I have searched every corner and swept up every grain of sand or remains of insects cast out by the ants and examined it with a lens.

" What can have become of it? Can it have burrowed into the earth? I take it, the ants would not have destroyed it after it had been in the nest for fourteen days.

" August 31st.—I have not seen my larva since; I look every day. I believe its food in great part was the droppings and pellets of the ants. I never saw it feeding on the brood, but it was often apparently eating on the floor of the nest. This is (as I proved, *see* Ent. Rec., vol. 24, p. 35–6, 1912) the food of the larva of the fly *Microdon mutabilis*.

" September 14th.—I have not seen my larva again, nor have I found its body or parts of it."

These observations of Mr. Donisthorpe's suggest one or two points worth discussion. The most important is as to the surmise that the larva hides for the winter in loose earth in or near the nest. As my plaster nests were devoid of earth, they afforded no facts bearing on such a point, but my most successful larva was much larger and older

than Mr. Donisthorpe's when it died, so that the theory looks very doubtful, but cannot be simply dismissed. If the theory be correct, this larva may again appear.

The other point is as to the food. Since my larvae eat the larvae of the ants, it seems unlikely that they would eat the droppings and pellets of the ants. Nothing in the behaviour of my specimens gave any confirmation to such an idea. I think it probable that Mr. Donisthorpe, who is, perhaps, not very familiar with the ways of Lycaenid larvae, was deceived by the slow to and fro lateral movements of the front and head of the larva, as it marches with dignified deliberation. The movement means probably making a silken ladder, and also perhaps is exploratory; at any rate, it is not very different to the movements of a slug or snail when eating growths on the surface of a tree or paling. In the case of the Lycaenid larva, however, it has nothing to do with actual feeding.

My own notes and observations follow.

August 2nd.—Placed a larva on nest of *D. flava*; it shortly found an opening and disappeared downwards.

August 3rd.—Another larva to-day did precisely the same as the one yesterday.

August 4th.—Took two larvae to Mr. Donisthorpe, which were placed in an observation nest of *M. scabrinodis* (*see* Mr. Donisthorpe's notes above), and brought home a nest each of *M. scabrinodis* and *M. s.* var. *sabuleti*, in plaster nests.

August 5th.—Placed a larva in each of the nests noted yesterday; the ants paid a little vague attention to them, but seemed neither pleased nor displeased with them, nor were they seen to get any "honey."

August 8th.—Failed to see a larva in either nest, and one at least was very completely scrutinised.

August 10th.—Mr. Donisthorpe reports one of the larvae in his nest to be quite at home amongst the brood, and to be "*distinctly* larger."

Amongst the debris from the nests found remains of an *arion* larva, shrivelled but not apparently injured.

August 12th.—Placed two larvae of *arion* in the plaster nest of *M. scabrinodis* var. *sabuleti*, one in what may be called the approach to the nest, the other in a central position at the moment unoccupied. The one in the approach, after a pause, began to travel slowly, and by what one can hardly suppose to be other than accident

went directly towards the opening to the next (more central) compartment, though it is, of course, possible the route followed by the ants had left some impression of the correct road. It finally got into the next compartment and advanced some 20 mm. therein. This journey did not take very long, and in the course of it various ants walked past it and over it, paying it no attention. At length one ant seemed interested, examined it, went round it and examined it with its antennae with care, the process occupying several minutes; at length it addressed itself to the honey-gland region in the orthodox way, standing behind and tapping the sides of the larva with its antennae, then passing its mouth over the last segments of the larva nearly everywhere, as if expecting something not very clear to it, and finally seemed to steady at the honey-gland, which it had previously passed over unavailingly, but which now obviously afforded something. On a further dealing with the larva, the latter bunched itself up in an attitude I had not previously seen; the ant then let it alone, but returning, the ant antennaed the larva variously, and the latter again bunched itself up—the head much retracted underneath, the thoracic segments swollen up, and the segments behind very attenuated, giving the larva a decided approach to the well-known outline of a Buprestid larva. I had never seen any approach to this form before, either in this or any other Lycaenid larva. In a few seconds, whilst I was marvelling over the matter, the ant passed its jaws over it in various directions, and seemed quickly to find the right place, picked it up by somewhere about the second abdominal segment, directly over the dorsum, and, the larva remaining in its curious attitude, carried it, as it would an ant larva or pupa, right away to the inhabited portion of the nest. The other larva wandered about a little, like the other unnoticed by the ants; but whilst I have been writing this note it has disappeared, and as the distance to cover was more than it could cover in the interval, it must have been carried off like the first one.

Later I placed a larva in a plaster nest of *M. scabrinodis*; after some minutes of neglect, the larva was in the outer chamber, an ant became much interested, and milked the larva over and over again. The process was curious: the larva would be walking along and the ant examining it, then the ant specially attended to the honey region, and, stationed usually behind the larva, it tapped it towards

either side with its antennae and advanced its head over the gland; the larva would then stop walking, retreat its head under the metathorax, and open rather widely the 6th to 7th abdominal incision, to a breadth dorsally of nearly half a segment width, diminishing to either side, an area conspicuous by being devoid of hairs or stellate hair-bases. For some seconds the larva and ant would be apparently motionless, the ant no doubt receiving honey. On the first approach to this position a definite drop of fluid was visible over the honey-gland just as the ant approached it, when it at once disappeared. After some seconds the ant left the larva, and seemed to have a deal of cleaning of its legs and antennae to do; the larva at once protruded its head and began to walk. Shortly the ant took several walks round the larva, then approached and went through the same process, and this was repeated half a dozen times, except on the first occasion no drop of fluid was seen, but after each occasion the ant did much cleaning, though there seemed no possibility of the honey or anything else having messed it. Then the carrying process was begun, in what precise way the ant instructed the larva was not clear, but it assumed the bunched attitude; this consists, as was more clearly seen on this occasion, in the larva swelling up the meso- and meta-thorax, and so depressing the prothorax forwards as to make the prothoracic plate face almost ventrally, instead of dorsally. The incisions, meso-metathoracic and metathorax—1st abdominal—were in this process widely opened, showing their smooth areas, and the remaining abdominal segments shrunk. This particular ant did not seem to quite understand its business; after several attempts it seized the larva by the meso-meta incision and carried the larva half an inch, but the process seemed uncomfortable, at least to the larva, which did not fully retain the bunched attitude, and the ant let it drop. The ant after an interval again milked the larva, and again got the larva to bunch, but failed to get hold of it properly, and finally walked off. A quarter of an hour later the larva was still walking about, but after a further twenty minutes had disappeared and was detected in the thick of the nest amongst ants and larvae. This nest has young larvae, but not any eggs to be seen.

August 14th.—One of the larvae in the *sabuleti* nest is obviously larger than it was, or than any larva just quit-

ting the thyme. The larvae in both nests walk about in their leisurely way, when the ants are induced to leave the crowded spots where they happen to be; but usually when the nest is first looked at on removing the screen they are not easily seen, and are hidden amongst the crowded patches of ants and brood; the ants seem to take no more notice of them than they do of each other.

August 15th.—The largest larva appears to be still larger, certainly more than twice the bulk of its first dimensions, and quite 1 mm. longer.

August 15th.—The largest larva with *M. scabrinodis* var. *sabuleti* measures 5·0 mm.; having come up to the glass he was easily measured; he was equally increased in height and width, and looked decidedly paler than when small.

In regard to the carrying in of the larva to the nest by the ant, the question arises as to whether the ant or the larva gives the actual signal for the portage. My own impression is that the initiative lies with the ant. In the preliminary process of milking, if the ant walks over the larva, it slows, but hardly stops walking, but as soon as the ant taps with its antennae for milk, and afterwards whilst the mouth of the ant is applied to the gland, the larva rests quite quiet, with its head retracted; the moment the ant withdraws, the larva extrudes its head and begins walking. As the time for portage arrives, the ant taps the larva more forwards, but not, so far as I noticed, very differently to what it had done before, and then the larva takes the attitude for being carried. In one case, the ant, from the attitude of sucking the honey, made a little gallop forwards several times, and it was after one of these that the attitude for being carried was assumed. On another occasion, when the ant made no very special forward movement, the larva assumed the special attitude, to which the ant paid no attention; it seemed probable that the ant had inadvertently done something that the larva took to be the expected signal, but the ant had clearly not reached that stage in the negotiations. Were it the larva that gave the signal, then the ant ought to have responded whether quite ready or not.

August 17th.—After frequently watching the larvae in the nest; all of them have grown more or less, the largest is over 5 and probably nearly 6 mm. long; the impression is received that the ants pay no attention whatever to the larvae; when they meet them they walk over them, never

appear to hold any communication with them, as they frequently do with each other when they meet. If the amount of watching has been sufficient, it would follow that the ants do not feed the larvae, but that the latter forage for themselves; there is nothing for them to find for themselves but the eggs and larvae of the ants, and considering that when older they eat the larvae, it seems tolerably certain that at this stage they feed on the young brood of the ants.

August 19th.—The largest larva is now 6 mm. long, stout in proportion, and of a fine translucent flesh-colour. I succeeded in establishing an observation nest of *D. flava* some days ago, but of a very amateurish structure; still it *is* an observation nest. I placed in it two larvae of *L. arion*, but they were, I feared, not sufficiently fresh. I have not since been able to discover any trace of them alive or dead. I hardly think either of them can possibly be there, but if this be so, I feel unable to decide whether the larvae were past a condition to succeed anywhere, or whether the *flava* were inhospitable. The pacific nature of *D. flava* in one respect struck me: they readily accepted queens picked up superficially on another nest, and supposed to be new queens of the season as yet unprovided for; but further, ants from another nest added to them were fraternised with, with hardly a question asked.

August 25th.—Larvae have been growing. At present there is in var. *sabuleti* nest a large larva 6·5 mm. long, and a smaller nearly 5·0 mm., and in the *scabrinodis* nest one nearly 6·0 mm. long; they are fond of resting on the sides of the compartments away from the ants. The ants run over them without paying them any attention, and I have not seen one milked.

August 26th.—The larvae do not look so well, especially the one in *scabrinodis* looks dirty and hardly so large. The others are a little dirty, seem less inclined to mix with the ants, *i. e.* are more often seen separate from the ants, by themselves, in the middle of a compartment or on a slope.

August 28th.—The *scabrinodis* larva looks bad, decidedly shrunken, little over 4·0 mm. long. The others much as at last note.

August 29th.—The *scabrinodis* larva is found dead, rather dried and nearly divided into two. The *sabuleti* ones don't somehow look flourishing, but are of about the same size as

noted on 25th. The smaller one is indeed rather larger, about 6·0 mm. long, it has some dark material over last segment or two, almost suggesting it had been bitten by ants and exudation had dried; the larger one has retreated into a small recess (opening prepared for communication with exterior) and has not moved since yesterday, whether ants are with it or not; it has a certain amount of dark incrustation (of dirt?).

29th.—Afternoon. The smaller larva is amongst the ants and moving about amongst them, apparently quite at home.

The present conditions suggest that at the stage the larvae have now reached they may have a habit of hiding amongst the looser materials in or over the nest, not, of course, afforded in these plaster nests, and feed less frequently (not at all till spring?), and do not associate so freely with the ants. At the recent rate of growth they would be full-fed in a few weeks more, yet probably naturally there is not from about this season onwards any excess of brood on which they could feed.

August 30th.—The dead *scabrinodis* larva, after a little soaking, expanded to nearly 8 mm., and looked very like it did when last seen looking well in the nest. It proved to have been cut into, but none of the interior had been eaten; the shrinking may have been due to desiccation or to the ants sucking the fluids; the honey-gland region looked healthy and uninjured, but over much of the larva were little hard black patches and spots that seemed to be the same as a (fungus?) disease that attacks larvae, and has frequently done so in larvae I have reared; the larvae when dead are often found to be very hard and solid throughout.

The largest *sabuleti* larva is found dead this morning in the nest, close by the recess in which it was noted yesterday as sheltering. It measured just over 7·0 mm., but looked a little shrunken, and its living length was probably 8 to 9 mm. It was apparently wounded (*post-mortem*?) in the honey-gland region. The cause of death appeared to be the black mark disease, of which spots were on most segments, but largely affected the 2nd thoracic and 1st and 2nd abdominal, the two latter being affected over nearly the whole dorsum.

The gut extracted from this specimen showed some accumulated material near the posterior end. It presented

no recognisable or organised material, unless one so accept some globules apparently of fat.

The remaining (*sabuleti*) larva, originally the smaller, is amongst the ants and brood and looks healthy, unless a blackness of the segments behind the honey-gland (possibly dirt) mean black-spot disease. It is about 9·0 mm. long, possibly 10·0; it does not happen to pose well for accurate measurement. Happening a little later to find the larva in a more convenient position, find it measures rather over 9·0 mm.

September 2nd.—Observed that the larva in *sabuleti* nest (the only one remaining) appeared to have voided some "frass." It was black, small in size, but of the ordinary form of lepidopterous "frass." It was rather soft. When put on a slide, pressed down and examined by microscope, it was seen to contain hairs, bits of cuticle and other portions of ant larvae or pupae, apparently by no means small ones. The larva was measured with approximate accuracy as 7·8 mm. long, 2·8 high, 3·0 wide; it looks clean and healthy except the "dirt" (or whatever it is) on the dorsum of 9th and 10th segments.

Amongst the ant material of the "frass" were also seen two jaws of ant larvae.

September 6th.—Examined two (one noted under dates August 2nd and 4th) nests (artificial) of *D. flava* into which larvae of *arion* had been introduced, and found no trace of them; this, however, goes for little, as both nests were defective—one without any brood and the other hardly established when the larvae were introduced. The observation only amounts to a failure to show that *arion* can reside with *D. flava*, and in no way shows that it cannot.

September 8th.—Happened to notice, as I had done on previous occasions, that the *M. sabuleti* placed the debris of their nest on a slip of glass used as a tray on which to provide them with sugar; it occurred to me, as it ought to have done before, that this debris might contain faeces of the *L. arion* larva. On examining the debris found that there were some items very like the faeces already reported on, viz. small dark-coloured objects about 0·6 mm. long, at first glance cylindrical, but on closer observation seen to consist of two nearly spherical masses closely pressed together. (The original deposit had this duplex character.) One of these placed on a slide and examined under a low power was seen to consist largely of hairs of the ant larvae,

and a second specimen was identical. The double pellets easily resolved themselves into two single ones when handled, and about two dozen of these single pellets were retrieved.

The glass had been put into the nest clean on September 6th.

A specimen contained jaws of ant larvae.

September 9th.—The ant midden was found this morning to contain nine of the rounded pellets of *arion's* dejecta; they contained several jaws, etc.; in one case the two jaws were still connected together by portions of the head. In all the examples mounted the hairs are often, perhaps usually, connected, a few together, by portions of the larval skin of the ant, as was not the case with the specimens from the spring (wild) larva.

I have never succeeded in seeing the larva eating, but the form of the rooms of the nest, with the Lycaenid habit of carrying the head withdrawn under the prothorax, make such an observation difficult, if indeed possible. The larva very usually has a position, with the head against the little mass of brood, and itself amongst the ants surrounding it. I say *little* mass of brood because there are not a great many larvae and pupae, the nest not being strong and the *arion* largely depleting them, of course. At other times the *arion* larva is, say, anywhere, owing probably to the ants not unfrequently changing the position of the brood nest, in accordance, I imagine, with the failure of my efforts to maintain for them a uniform dampness, and with my so frequently disturbing them for observation.

September 13th.—The larva has not been so well for a few days, has more lines of dirt (?) on it, and to-day only one small (supposed) faecal deposit is found.

September 14th.—Larva lies this morning on its side, dead, very little shrunk, no cause of death obvious except the black lines suggesting fungus disease. No deposits this morning.

After this date nothing at all resembling the *arion* excreta have been found in either nest. It occurred to me that it might be suggested that the ants, perchance, tore up the larval skins when they were cast, on change to pupa, and carried them out mixed with some soft material to the midden, and that the *arion* excreta were really ordinary ant products. Both before and after the death

of the last larva, I examined the midden materials and found therein the cast skins of the ants, shrivelled and a little dirty, but otherwise sound and intact. One of these skins is shown in photograph on Plate XLIX, fig. 2.

The last excretum of *arion* (only one) was found on the day preceding its death. I feel no doubt that these were really the excreta of the butterfly larva. The ants did not feed the larva, and its rapid growth could not possibly be accounted for, if it fed on the ants' droppings, which were, however, always plentiful enough in the midden, as small oval pellets usually black but sometimes pale and less than half the diameter of the *arion* pellets. In the midden section of the nest the plaster was disfigured by many small black spots, apparently excreta of some sort of the ants, but the living portion of the nest was almost free from any such disfigurement. By making errors in keeping the nest properly moist or dry, one forced the ants to change their residence from one cell to another, and at the same time confused them as to which place was properly the midden.

On Plate XLVIII I have placed photographs of portions of slides of the *arion* faeces, which show the very largest portion of ant larval skin I could find; usually the portions are small, so as only to have a few hairs in each, much as shown on Plate XLVII.

Those larvae that died and whose interiors I examined had, practically, no intestinal contents. The larva taken in spring had the intestine rather loaded, which led me to believe that it voided no excreta whilst living with the ants. This is obviously not the case with the larva in autumn, though it continues probable that it is so in spring.

Both my larvae and Mr. Donisthorpe's fed up in four or five weeks to a length of from 7 to 9 mm. If this be compared with the size of the larva in May, the difference is not very great, and the extra growth was probably all made in spring. At any rate from September to May the larva grows comparatively slowly, and probably is quiescent for most of the time. Whatever was the immediate cause of death of my larvae, it seems not unlikely that the true one was that the plaster nests afforded no proper shelter for this purpose. Against this is the fact that my last larva fed fairly freely up to a day or two before its death.

The facts here reported give us in any case a fairly com-

plete view of the life of the larva of *L. arion* in its last instar, which has been such a puzzle and mystery to us all for so many years. They are so remarkable, as in some degree to explain why they have so long resisted our efforts to observe them.

The interview of the larva with the ant (*Myrmica*) is not unlike in its first stages that of an ant with any other larva of a blue that has a honey-gland. But its culmination in the ant carrying the larva into the nest is not only remarkable as a simple fact, but the extraordinary change of form which the larva assumes during the process is astonishing.

I have long been of opinion that the ants collect the larvae of *P. argyrognomon* and *A. coridon* (and no doubt of other species) and carry them to special plants on or close to their own nests; but, so far as I know, no one has seen the actual transfer take place, so that one cannot say that these larvae when so carried do not behave in the remarkable manner observed in *L. arion*.

When the larva is in the ants' nest, it appears to have no protection against the ants of any sort. The ants appear to be entirely neutral towards it, paying no attention whatever to its presence either in a friendly or inimical way.

When the ants were undisturbed, either by exposure to light during observation, or by undue variations of moisture, they were always in little crowds over their brood, and the larva of *arion* almost always had a place amongst these with its head directed towards the brood. That the ants should be so indifferent to its presence whilst it was devouring their brood is difficult to understand, the more so that I never saw any ant obtaining "honey" from it, or apparently examining it with that object. This must, however, be taken *cum grano*, because when the ants (and larva) were under observation the intrusion of light into the nest of course interfered with the natural and usual behaviour both of larva and ants.

I have a natural nest of *Myrmica laevinodis* supplied with four larvae of *L. arion*; whether an examination of this by and bye will add to my knowledge remains to be seen, but I am not very hopeful.

Of further points in the life-history of *L. arion* that have still to be discovered the most interesting and obvious are, perhaps, the question as to what species of ants, beyond

the two or three species of *Myrmica* which we know to welcome it, afford habitats for its larva in their nests, and what are the species which it is unable to quarter itself upon, and, as a second point, whether the larva passes the winter in close association with the ants, or finds a more or less separate apartment in which to spend the period in which it is more or less dormant and does little or no feeding.

Explanation of Plates XLVII–XLIX.

PLATE XLVII.

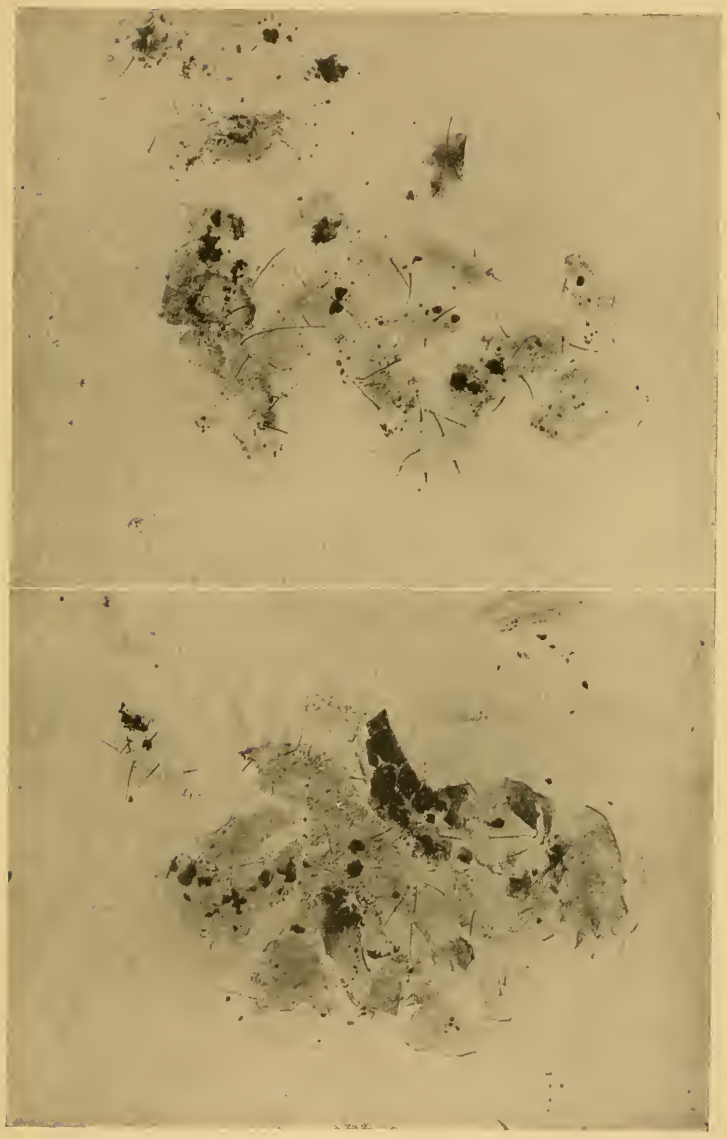
Two photographs of portions of faeces of *L. arion* larva (Sept. 2, 1915) × 45.

PLATE XLVIII.

Two portions of *arion* faeces. These were selected as showing the largest portions of the skin of the ant larva in one piece; generally they are in small portions, as in Plate XLIX × 45.

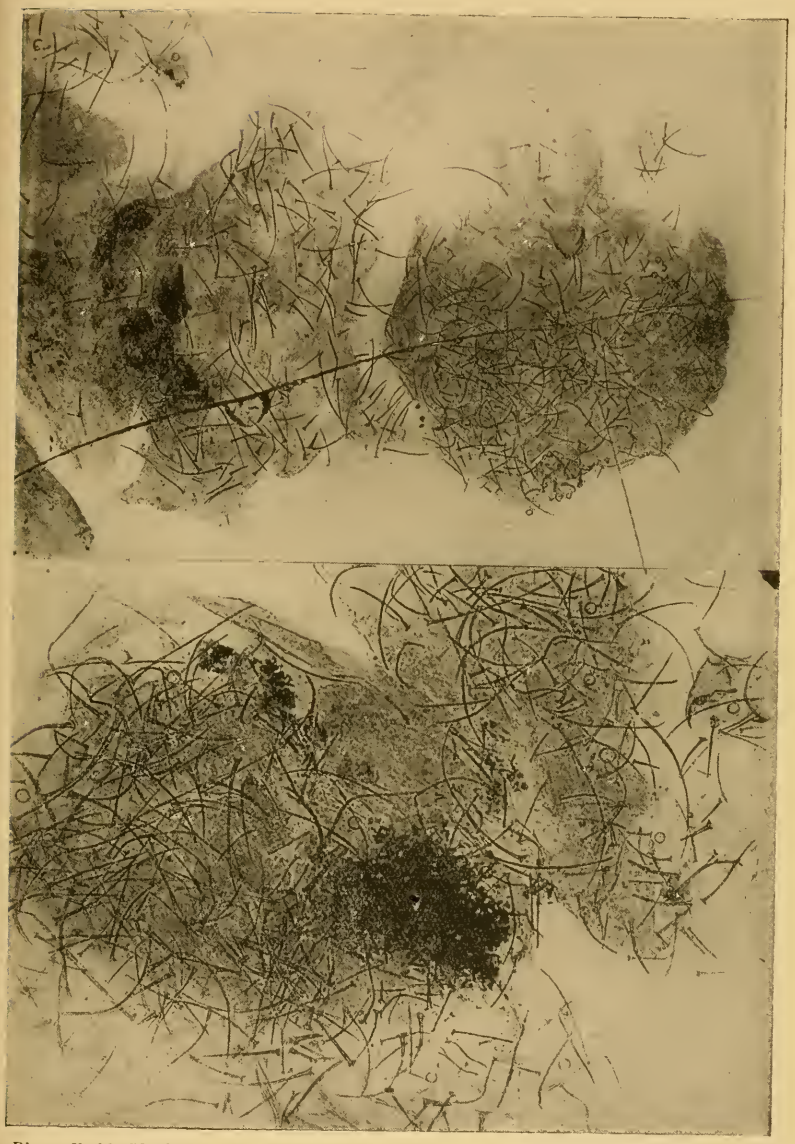
PLATE XLIX.

Shows, fig. 1, another portion of *arion* faeces, the bits of ant larva being small × 45; fig. 2, a cast larva skin of the ant, such as were easily found in the debris of the ant midden × 35.



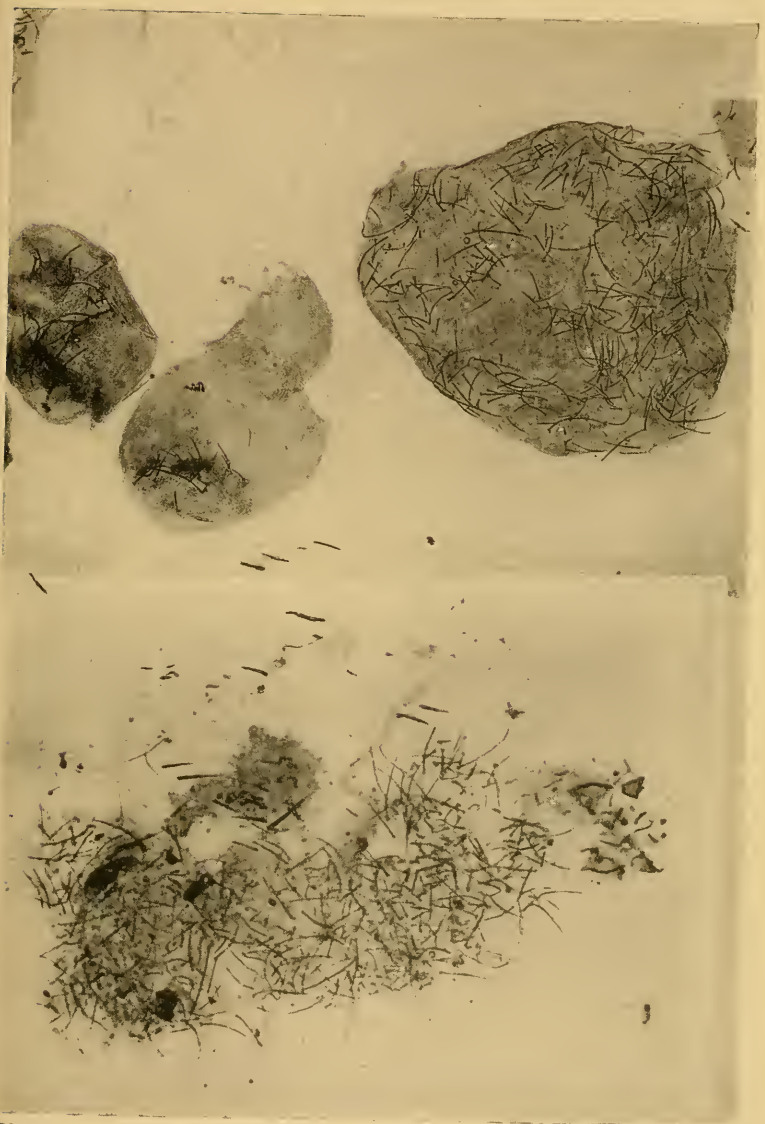
Photo, F. N. Clark. *Anglo-Engraving Co., Ltd.*

FAECES OF L. ARION LARVA × 45.



Photo, F. N. Clark. *Anglo-Engraving Co., Ltd.*

TWO EXAMPLES OF ANT LARVA HAIRS FROM FAECES OF ARION LARVA × 45.



Photo, F. N. Clark and A. E. Tonge. *Anglo-Engraving Co., Ltd.*

FAECES OF ARION LARVA, AND CAST SKIN OF MYRMICA LARVA.

XIII. *Further observations on the last stage of the larva of* Lycaena arion. By F. W. Frohawk, M.B.O.U., F.E.S.

[Read October 6th, 1915.]

Plates L, LI.

The following notes on the observations I have been enabled to carry out under natural conditions, are entirely due to the unlimited assistance which my friend Capt. Purefoy has most kindly accorded me, by his very elaborate and successful experiments carried out in the establishment of a large collection of ants' nests, most carefully transplanted in his garden at East Farleigh, Kent. I may here state that the bulk of the nests comprise chiefly a common garden ant (*Myrmica laevinodis*) and the small yellow species *Donisthorpea flava*. All the nests were transplanted last April, so that when the experiments with *L. arion* were started last August, both the nests and the whole of the growth (consisting of wild thyme, *Lotus corniculatus*, etc.) covering and surrounding the nests were thoroughly established. These ant nurseries, as I may term them, are absolutely in a natural condition for observation purposes, which adds vastly to the interest of such research. Before recording our observations, I should here wish to express my sincere thanks to Capt. Purefoy for his kindness, and also to Miss Ley, who has rendered invaluable help by her untiring patience as an observer, as well as for her expert management with the earlier stages of this remarkable butterfly.

The first important and very interesting news respecting *L. arion* I received from Capt. Purefoy in a letter written on August 9, stating he had seen at 5 p.m. the day before, a *laevinodis*, who had milked the larva several times, suddenly seize it bodily and rush off with it. After this good news I arrived at East Farleigh on August 13 when Capt. Purefoy, Miss Ley and myself made some very interesting observations that evening and again the following morning, during which time we turned down four *arion* larvae,

which had just passed through their third and last moult ready for entering their new and remarkable mode of existence.

At 4.45 p.m. (August 13) we placed No. 1 larva on the ground, which was partly cleared of growth, near the ants' nest; it wandered slowly about and was found by one of the ants (*laevinodis*) at 5.50. The ant at once milked the larva and remained with it until 6.30, when it seized the larva and carried it off to one of the main entrances of its nest, where three other larvae had been previously taken during the past few days by *laevinodis*, which Capt. Purefoy had seen.

No. 2 larva was put down near the spot where No. 1 was placed. No. 2 was found by a *laevinodis* just after 6.30, and was carried off at 7.30 to the same main entrance; it was at first taken down the mouth of a small passage adjoining, but the ant reappeared, backing out with the larva, and continued its backward career down the main entrance carrying the larva, while two other ants at the entrance saluted them as they passed by, immediately before disappearing down the tunnel.

No. 3 larva we turned down at 11 a.m., August 14. This was placed on another bed of nests; it was shortly afterwards found by a *laevinodis*, in full sunshine, and carried off to one of the nest entrances at 11.30. This particular larva hunched itself four times before being seized by the ant.

No. 4 larva was put down (close to the spot where No. 3 was found by the ant) at 12.35, a *laevinodis* found it in eight minutes and carried it off to the centre of its nest, covered with thyme, etc., at 1.3 p.m.

In each case all four larvae and ants behaved precisely similar, except No. 3 larva, which signalled four times. The individual ant which first finds the larva is always the one to seize and carry it off. Although during its attendance several other ants may find the larva and stay by it a short time, and even milk it, they soon leave it to its original attendant, who apparently informs them that their services are not needed.

Whether the ant signals to the larva for it to prepare itself for transit, or the larva gives the ant the signal that it is ready to be taken, seems doubtful; but from what we have seen both Capt. Purefoy and I are inclined to think that the larva gives the signal. No. 3 larva alluded to

hunched itself both the second and third time while the ant was about an inch away and facing an opposite direction, and at the fourth hunching up the ant was standing over the larva ready for the signal, and when this was given it was quickly seized and carried.

Capt. Purefoy tells me that in every case—numbering as many as eighty-two—the ant which first finds the larva is the one that carries it away, as witnessed by either Miss Ley or himself.

Only yesterday, October 5, I again visited the ants' nurseries at East Farleigh, when we carried out further very interesting observations, by so doing bringing them up to date.

Upon removing part of the side of a large nest of *laevinodis* in which we had previously seen larvae taken, we found no fewer than six very healthy *arion* larvae, varying in size from about 6 mm. to 8 mm. These were fairly equally distributed over a space of about eight inches on the same level, and about five inches below the surface. Five were quietly resting in the larger galleries of the nest, each apparently in its selected chamber, as we found the surface upon which they rested to be finely carpeted with a slight layer of silk. The sixth larva was amongst a brood of *laevinodis* larvae and had several ants in attendance; it was then apparently in its dining-room. It is probable that they rest in certain selected parts of the more spacious galleries to which they return after each meal, but this of course remains to be ascertained.

From observations we have made it appears highly probable that the little yellow ant (*Donisthorpea flava*) is an unsuitable host, and that it is incapable of carrying off such a comparatively bulky burden as the larva of *L. arion*.

During August last I placed as many as seven *arion* larvae just after moulting, on a natural nest of *D. flava* established in a large flower-pot; these all entered the nest by themselves, they were not carried by the ants, although they were milked by them. A month after the last had entered, I very carefully searched every particle of the nest without finding any trace of the larvae. The nest contained broods of *flava* larvae, and it was impossible for the *arion* to have escaped from the nest.

If *D. flava* proves to be, as I firmly believe it will, an unsuitable host for *L. arion*, it explains the cause of failure

in finding *arion* larvae in the great number of *flava* nests I have from time to time searched in the Cornish habitat of this butterfly, although *L. arion* in a wild state freely deposits on the thyme growing on the nest mounds of this small yellow ant.

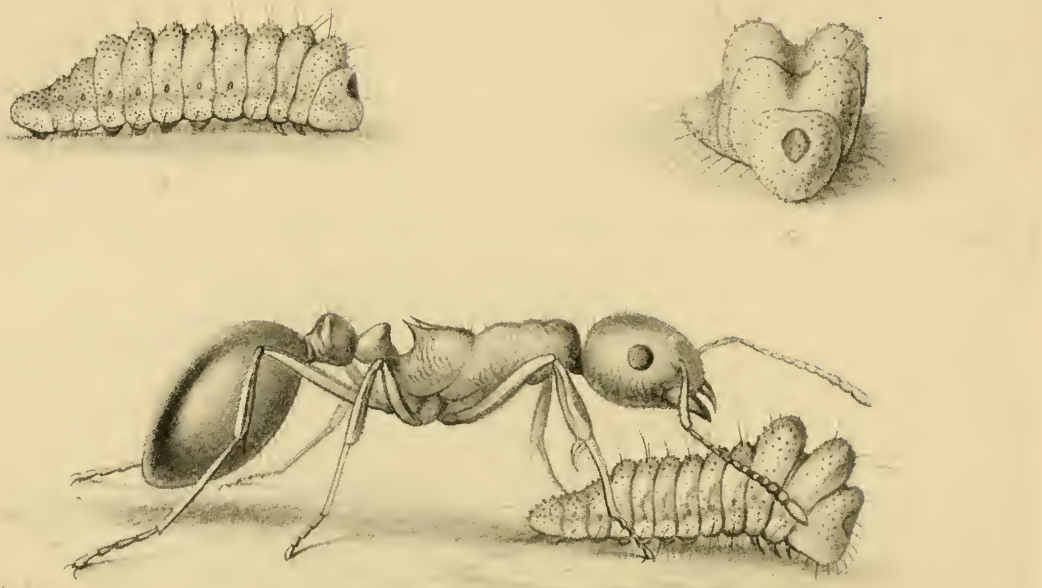
Explanation of Plates L, LI.

Plate L. *Myrmica laevinodis* and larva of *Lycaena arion.*

A. Larva in normal attitude.
B. Larva hunched ready to be carried.
Myrmica laevinodis about to seize larva.
(After rough sketches from life, 6.30 p.m. August 13, 1915.)

Plate LI.

Myrmica laevinodis carrying larva to its nest.
(After rough sketch from life, 11.30 a.m., August 14, 1915.)



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MYRMICA LAEVINODIS AND LARVA OF LYCAENA ARION.

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MYRMICA LAEVINODIS CARRYING LARVA TO ITS NEST.

XIV. *Experiments on some Carnivorous Insects, especially the Driver Ant* Dorylus; *and with butterflies' eggs as prey.*

By C. F. M. Swynnerton, F.L.S., F.E.S.

[Read May 5th, 1915.]

I have experimented at one time or another during the past few years in the food-preferences of various carnivorous insects. I include in the present paper only my experiments on driver-ants, and those in which insects' eggs were used as prey.

The driver-ants employed were *Dorylus* (*Anomma*) *nigricans*, Illig., var. *molestus*, Gerst., abundant on and about Mount Chirinda in S.E. Rhodesia. In the wet season (November to April) the collector comes across columns of them, particularly in dense forest, where the first intimation of their presence very frequently consists in sudden sharp bites all over his legs—or hers; for on two or three occasions some lady whom I have been escorting through Chirinda has disappeared suddenly into the undergrowth, and I have myself had to seek out some suitable spot further on in which to await her. I say "suitable" advisedly, for once, while striving to free myself of the intruders, I found them literally swarming all over me, and realised too late that in my haste I had sat down to search for them in another part of the same highly populous column.

The main column sometimes marches as many as twelve or fourteen abreast: I do not of course mean to imply that the ants are in definite lines. It is margined on each side, however, by a line, serried or broken, of grenadier-sized guards, each facing outwards with great uplifted mandibles or patrolling about on the flanks. Within the column there is usually a current in both directions, but very commonly mainly in one; and smaller "loop" columns help to prevent congestion and to serve, apparently, other special purposes. Over a foot, or, it may be, much more, of the ground on each side wander scattered stragglers that seize on any potential prey, from a minute beetle to a cow, that is so foolhardy as to approach them, and, aided, when struggling attracts attention, by the

other ants near, drag it (if they can) into one of the columns. It is these stragglers that, in my particular experience, are the more frequent mark of the fly, the habits of which have been described by Mr. W. A. Lamborn (Proc. Ent. Soc., 1913, cxxiii–cxxviii).

Following the column, as it winds through the forest or over the grass-country, we may at last come to a place where the ants are scattered in hundreds of thousands everywhere, and are definitely searching—all over the ground, up the grass-stems, and up, sometimes for some distance, even the stems of trees. It is under these circumstances that I have on a few occasions, with insects abundant, been so fortunate as to witness the scene that Thomas Belt described so graphically, in connection with *Eciton predator*, in his fascinating "Naturalist in Nicaragua"—the seizure of the fleeing insects, the eventual overpowering of even grasshoppers, the clustering of the prey on the tops of the herbs and grasses, and its drop into the thick of the ants below when approached by those that climbed after it, and the escape by suspension of spiders and larvae. I have also on a few occasions watched birds attending *Dorylus*, as Belt says they attend *Eciton*, to rob stragglers of their prey, and for the sake of the flying and hopping insects flushed by the ants. Some of the birds on occasion eat the ants themselves. In my experiments on many species of insectivorous birds I found that some ate ants generally, including *Dorylus*, far more readily than others. Of these others some showed a strong repugnance to them, and it is doubtless in relation to this latter class of enemy that ant-mimicry finds its main use. Yet even the birds that prey on ants show caution in attacking *Dorylus* in column, merely (in my observations) dropping down to stragglers and hastily returning to their perch.

Ants of other species become very uneasy when drivers are near, and the carrying out of the contents of their nurseries by those that inhabit my verandah posts has often been a warning of the necessity for putting on pots upon pots of water to boil. Not that it is with anything but reluctance that one pours boiling water on these animals, so useful when they confine themselves to the Kaffirs' quarters, the kitchen, and the kitchen garden. But it is unpleasant to have to turn out at a moment's notice, at night, oneself; and, in my case, numerous live birds in cages in the verandah had to be protected from

an enemy that would have made short work of them. *How* short, is suggested by the following incident. Some years ago (1902–3) three goats died under circumstances that suggested meat hunger on the part of my Kaffirs. Not to gratify them, I pretended to poison the carcases (using only salt, however), and placed them out in a lonely part of the Chirinda forest "to kill wild beasts." I might have spared even the salt, for they speedily became protected against the most venturesome native—or "wild beast"—by a dense, black, seething mass of "Idunga." They remained so for only a very few days. Then the ants resumed their more normal avocations, and left three skeletons behind them. It sometimes happens too that great stampeding is heard in the kraal or shed at night amongst whatever animals are enclosed in it, and, going out gun in hand, expecting perhaps to find that leopards have broken in or that lions are trying to make the animals break out, one finds the place full of—drivers.

I have on one or two occasions found quantities of chitinous *débris*—of millipedes, grasshoppers, beetles and other animals—mixed with earth in a heap outside what seems to be, at any rate, as near an approach to a permanent habitation as these ants employ; and once, in my garden, my foot suddenly went through and revealed a hole, perhaps eighteen inches deep, which was full of the driver-ants, though, it being in the dry season, it was long since I had seen them about. I could hardly have investigated properly without cyaniding them, and I did not wish to lose the protectors of my garden; but the discovery, and the fact that on several subsequent occasions I found them still there, suggested that they do possess headquarters and occupy them for prolonged periods.

It struck me early in 1911, when *Dorylus* was specially active in the neighbourhood of my house, that it would be interesting to ascertain whether any non-flying insects are protected from these marauders. I accordingly carried out the experiments I shall describe first. Two years later I carried out the experiments with butterflies' eggs.

I had found, in the numerous experiments on many insect-enemies in which I had used adult insects as prey, that not only do differences in acceptability exist, some species being obstinately refused while other species are eagerly eaten, but that the finest gradation exists between those insects (Z) that are only accepted when the enemy

is hungry, though Y, X, W, etc., refused in turn as he fills up, to the few species (A) that are regularly eaten by him at all stages right up to repletion-point.

This fine grading in degrees of palatability was unexpected—though Mr. Marshall's experiments had shown that *some* grades might be looked for—and, starting with a bias in favour of the "palatability" of most *Nymphalinae* and *Pierinae*, I at first fought against it; but I could not long withstand the combined testimony of every animal I experimented on.

Fine gradation in palatability granted, with its corollary that few species are at all times acceptable to all their enemies, it was interesting to note its theoretical bearing. This seemed to be, that there are probably few species that do not sometimes require to be distinguished by an enemy from such other species (or, an important and highly explanatory consideration, from their own parent form) as are at the moment acceptable to him. The selective factors would be the unmistaken refusals and the mistaken attacks of enemies, adult and otherwise (for I find that even the former go on all their lives making numerous mistakes and that they also tend to test specially anything of unusual appearance).

Yet distinctiveness and diversity are nearly as marked in the eggs of Lepidoptera as they are in the fully developed insects that lay them.* These eggs are laid on exposed surfaces liable (as I have many hundreds of times seen) to the *exceedingly* close scrutiny of small warblers, white-eyes and other minutely-searching enemies; they are often in contrast to those surfaces and are commonly, even when not thus in contrast, distinctive; and this distinctiveness is apparently in part for visual effect, for it is absent from the hidden bases of the eggs, nor is it approached by that of most underground eggs known to me, the differences between which are merely such as might naturally result from the fact that their parents are different. I thought, therefore, that it would be interesting to ascertain whether nauseousness—and graded nauseousness at that—was present in leaf-laid eggs.

I was very unlucky in my attempts to secure a suitable

* I lay stress on *distinctiveness*—recognisability when detected—rather than on *conspicuousness*, for I regard the latter as a purely auxiliary quality, though highly useful and likely always to be selected so far as it can be safely carried.

animal on which to experiment. Two or three broods of small warblers that I tried to rear failed, and I could not secure a fully-grown bird of a suitable species. Finally I had to use driver-ants, unsuitable in so far as they possess no sight, yet suitable in their general apparent readiness to eat any animal substance, and in the fact that they must very commonly indeed meet with lepidopterous eggs when searching the herbs and lower shrubs on their foraging expeditions. I also tried other insects—cockroaches (suitable mainly in the fact that they are credited with the readiness to eat or, at any rate, try any food of an animal nature), a carnivorous ladybird (*Alesia bidentata*) and a cricket (*Arytropteris* sp.), which has often been a great nuisance to me, devouring insects of many kinds that I have left on the verandah table.

Obviously the animals were not perfect for my purpose; yet I felt that *rejections* by the drivers, the cockroaches and the cricket, also any preferences any of them might show, would at least, for the reasons I have indicated, be suggestive, though of course by no means conclusive. I therefore carried out on them the experiments which I shall describe.

A few remarks on the eggs used are comprised in the concluding section of this paper.

Note.—I have mentioned the fine grading of prey that occurred in my experiments on insectivorous birds, wild and tame, and the suiting of the capture or acceptance to the exact state of appetite of the moment. I show a diagram to illustrate these "layers" of appetite. It is also true (and this too has an explanation bearing on Dr. G. D. H. Carpenter's highly-interesting observations, read to-night *) that a rapidly digesting animal may go on eating a fairly low-grade insect (such as I have found many Lycaenids to be), or even *very* low-grade species, indefinitely, with occasional short intervals, if higher-grade prey is not available in sufficient quantity to carry it to a more advanced stage in the process of filling up. Thus a swallow of mine ate more than 80 *Neptis* and a small hornbill (*Lophoceros*) more than 50 *Danaida chrysippus*, in each case in quite a short space of time; a rest of a few minutes after each refusal, accompanied doubtless by subsidence, rendering the bird's digestive apparatus capable of dealing with three or four more. The swallow

* Proc. Ent. Soc., 1915, p. lxiv.

even ate more and at least as great a weight of *Neptis*, when thus verging continuously on the *Neptis*-refusing point, than it did of the better-liked *Pyrameis* at far nearer repletion-point in the same space of time. The possible bearing of this on some of the observations in which a bird has been seen preying continuously on *Danainae* is obvious; and a long-ago expressed view of Prof. Poulton's, based on his own experimental results, is also borne out—that it is only in the presence of pleasanter insects that unpleasant species will derive advantage from their special defence.* My experiments have shown, however, that it is a matter of relative indigestibility rather than of unpalatability, that a bird can digest species of prey when hungry that fail to stimulate the digestive secretions when it is fuller, and that a bird, enabled like my swallow and *Lophoceros* by a rapidly working digestion to prey fairly continuously on low-grade prey, probably never approaches repletion-point while doing so.

1. Experiments on *Dorylus* (*Anomma*) *nigricans*, var. *molestus*

April 26th, 1911.—A large stream of driver-ants was flowing in both directions between two tunnels, at the foot of a steep bank and under the verandah curb respectively.

I put down in the middle of the stream four *Mylabris amplectens*, Gerst., two *Amauris albimaculata*, killed by myself as I put them down and smelling strongly of ordinary gas, three *Epilachna polymorpha*, Gerst., and a *Zonocerus elegans*. All were at once overwhelmed by the drivers, and for some minutes remained so. Ten minutes later I found that the numbers clustering round the four *Mylabris* and the three *Epilachna* had thinned considerably, but the ants were still in masses on the *Zonocerus* and were busily engaged in cutting off the wings of the *Amauris*. A *Belenois* that I now put down was attacked at once, its wings cut off and left lying, and its head, thorax and abdomen carried into the bank "drive" before either *Amauris* was ready to follow it. A *Rhopalocampta libeon* was at once seized and carried along bodily, its wings being removed while it was in motion, and the two *Amauris*, their wings left where their owners had first been put

* Proc. Zool. Soc. Lond., 1887, p. 191.

down, followed it, also in sections. By this time the ants had entirely abandoned the four *Mylabris* and the three *Epilachna*. One of the former was on its back motionless, another was remaining quite still—head held down—in the centre of the stream of ants; many of them felt it with their antennae as they passed, but no attack was made on it, and the other two as well as the three Epilachnas were calmly marching off. They drew attacks in doing so from the ants they passed, and the two *Mylabris* in particular were occasionally overwhelmed for a moment and perhaps dragged back a little. But they were always abandoned again after a time and they made good their escape. I took them up and found that both *Mylabris* were still able to expel juice fairly freely, the *Coccinellidae* (with one exception, not, however, so freshly caught when given), apparently not. The *Zonocerus* continued to be the centre of attraction for large numbers of ants, but they were making very little headway in the process of its dismemberment.

I now inserted four larvae, one of *Papilio demodocus* at about the end of the brown-and-white stage, one of *Amauris albimaculata* (about $\frac{1}{3}$ grown) and two of *Acraea acara* ($\frac{1}{4}$ and $\frac{1}{3}$ grown respectively). All were at once surrounded, but the attack on the *Amauris* larva was not of a very formidable nature: the ants used their antennae rather than their jaws and evidently disliked it intensely, for they very speedily abandoned it entirely. In making off, which it did apparently quite undamaged, it drew a few attacks, but these proved to be no more formidable than the first, and the larva was each time quickly abandoned. The *A. acara* larvae were more seriously attacked, but the ants had the greatest difficulty in getting "in" at them, the much-branching spines beaded at all the extremities with the yellow protective juice everywhere barring their way. A number of these spines were in each case shorn by the ants (some close off to the skin) during the attack, but they finally abandoned both larvae, and, though I frequently replaced both these larvae and that of the *Amauris* in the centre of the ant-column during the remainder of the experiment, the subsequent attacks, when any were made at all, were less serious than the first, and the larvae were each time allowed to escape. Very different was it with that of the *Papilio*. It at once extended its red filaments on being attacked,

but though the one or two ants in their immediate neighbourhood retreated for the fraction of a second they at once closed in again, and, overwhelming the larva, carried it speedily along (a distance of about three feet) into the verandah drive. A hive-bee at this moment came tumbling into the "drivers" from above. It was at once seized by the leg by one of the larger warriors, and remained tumbling over and over and drawing more enemies. I noticed that it extended its sting, but only to have it seized and tightly held by one of the drivers. It was quickly subdued, and when I last saw it was being carried in the direction of one of the drives. I now placed a large *Danaida chrysippus* in the column, first killing it. The ants at once persistently attacked it, and, having carried it just outside the column, commenced to dismember it. A smooth moth larva with a velvety appearance and conspicuous black and white bands (*Aletis*?), not uncommon in the forest, was seized, and after a very great deal of delay carried along to the bank drive, though the ants again refused the *Amauris* and *Acraea* larvae. It had been three days in captivity without my having been able to find its food-plant and was undoubtedly weakened—probably in its protective qualities too. A *Papilio echerioides* ♂ was broken up, its wings left lying, and its more material parts carried in sections to a drive. A small Sciarid fly with black wings and a red thorax (*Apelmocreagis thoracica*, Macq.) had been settled on the ground right amongst the ants, neither taking any notice of them nor drawing an attack. I captured and disabled it and placed it back amongst them, but though numbers, I might say hundreds, inspected it, often passing their antennae over it, all moved on and no attack whatsoever was made. But an Arctiid moth, *Rhodogastria bubo*, was at once attacked and its wings stripped off where it lay. It had unfortunately exhausted its foamy thoracic exudation previously to being placed amongst the ants: this might have made a difference. A *Mycalesis campina* was at once carried along, as were also a second *Danaida chrysippus* and a *Byblia ilithyia*, their wings being stripped off *en route*. It was now an hour and a quarter since the experiment commenced: the *Mylabris* left in the column was still in the same place uneaten but motionless, and no longer noticed by the ants. On my taking him out he immediately commenced to move about, but dragged three legs

after him: the two previous *Mylabris* had escaped to all appearance quite without damage excepting for a slight wound on an abdomen. The fourth *Mylabris* had, as I ascertained, quite exhausted its juice. It had latterly been receiving a good deal of attention from the ants, which were at this moment busily cutting off one of the elytra and were carrying its owner along. They soon abandoned it again, but when I removed it later I found it to be dead. The large ♀ *Zonocerus* was lying where originally placed, but had been reduced a good deal and was still a great centre of attraction. The small fly was still lying neglected in the midst of the ants. A *Mylothris rueppelli* was now broken up and carried off, as were, without breaking, a housefly and a common cockroach. Three of the ants themselves which I killed and put back in the column were felt by large numbers of their comrades, but always passed by until suddenly one smallish ant, coming across one of them, seemed to think it her duty to lift and carry it along. I removed one of the other two and placed it in another ant-army of the same species which was busily crossing a garden path at a considerable distance away, with, as so often, a drive at each side. It, too, was neglected for the three or four minutes during which I watched.

The first ants had shown no special ferocity towards myself, but this second party at once attacked me, and I had to keep a sharp eye on my feet. Judging that they might also be in the mood to take more highly unpleasant insects than their comrades had accepted, I brought over an *Epilachna*, a *Mylabris* (adding a second from the two that had escaped), the small fly, the *Amauris* larva and one of the *Acraea* larvae; all these were still being neglected by my first band of ants. Placed just beside the column all were at once attacked furiously. The *Acraea* larva (it was the larger one) was gradually shorn of spines and finally carried into a drive, as were *both Mylabris* and the Coccinellid. The *Amauris* larva was attacked just as furiously and was apparently freely bitten, for blots of greenish black juice sprinkled the ground on either side of it. These seemed to fall just *away* from it: were they *emitted*, *e. g.* by the filaments? But the original attackers gradually desisted and left it, though it was still for some time attacked by groups of ants that apparently came across it for the first time. Finally it was left alone

entirely, and, looking back at it at the end of the *Acraea* larva incident I was surprised to find it half-covered with little heaps of tiny fallen leaflets from an overhanging *Acacia baileyana*. Watching, I saw several leaflets and in one case a portion of a midrib with a few leaflets attached brought up and placed on it by the ants. The fly had appeared to be attacked for a few moments with the same vigour as were its fellow victims, but evidently the onslaught was not with pointed weapons, for apart from the loss of a wing it seemed to have sustained little or no damage when the ants abandoned it. It lay in the midst of them and, whenever I moved it, was at once set on to by the ants, but they quite evidently had no use for it and each time speedily desisted. The fact that the two *Mylabris* had already undergone an ordeal at the hands of Column No. 1 and that one of them was certainly destitute of "juice" might, I thought, account sufficiently for the comparative readiness with which they and, for that matter, the *Epilachna*, had been taken. I thereupon captured (within a few yards of the column) two more, also just afterwards a fresh *Epilachna*, and at once, as I did so, put them in. I happened to drop one *Mylabris* close to a vertical shaft that was guarded at its mouth by a large number of ants. It was at once pulled in. The second, placed further along, was attacked with great fury and carried along for some distance, then partially abandoned, then attacked again and so on. Finally, after a considerable time, it was left out to one side of the column and partly covered over with leaflets like the *Amauris* larva. The latter had now emerged from its covering and was crawling towards the column. It was attacked three or four times, particularly when it arrived at the column, but never very seriously—the ants mostly desisted directly they came into contact with it—and it passed out on the other side. On picking it up I found that it seemed not greatly the worse for its experience. The front pair of filaments were hanging down limply and all the others were partially collapsed, but on my setting it on a leaf of its local Asclepiad food-plant (*Cynanchum chirindense*, S. Moore) it at once commenced to eat. The fly, put down again, was treated with the same respect as previously. But a large beetle, *Psammodes* sp., now introduced was attacked furiously and was quickly concealed under a mass of ants. Nevertheless, it gradually crawled

away, the ants lessening as it went, and on getting off the open path and passing through some vegetation it succeeded in brushing off most of those that remained. It was greatly incommoded by them, and kept stopping to brush them away with its forelegs from its palpi and antennae. When I finally recovered it, several yards from the ant-column, only three ants were left clinging to it, and it seemed to have been effectively saved by its armour from all injury. The *Epilachna*, I should have mentioned, was attacked vigorously for a time, and afterwards for a longer period in a desultory fashion. It at first remained adpressed closely to the ground, and the ants plied their mandibles in vain over the glossy surface of the elytra; then one or two pushed under and turned it over, and it was carried along a few inches. This sort of thing went on for some time—I could not see that it made use of any juice it may have possessed. In any case, the ants made very little impression on it, and did not shift it very far from its original station.

At this point, having just captured a passing *Acraea neobule* ♂ and an *A. natalica*, dull ♀, I went with them to Column No. 1, and found the last remains of the *Zonocerus* disappearing into the drive. I removed a forewing of *A. neobule* and placed the butterfly amongst the ants. Disabled even to that extent it seemed to have no difficulty in its flutterings in shaking off such as clutched it, and a butterfly of its size, able to fly, would, I have little doubt, experience very little trouble in getting away from a crowd of drivers amongst which it had inadvertently landed. I killed it and replaced it. There was quite the normal amount of juice, but the ants made as short work of it as they had done of *Amauris* and *Danaida*, separating the wings from the body and carrying the latter into their tunnel. They then refused, in the same manner as before, to eat the *Amauris* larva and the fly, attacked a *Mylabris* and desisted, then attacked and carried in the *Acraea natalica*. It too possessed a normal amount of juice, and small drops of this exuded at the nervures when I cut the wings off.

Returning to Column 2 I found the *Mylabris* and the *Epilachna* in the same place. I put down two coffee-bugs (*Antestia variegata*), a small weevil (*Systates* sp.) common in coffee, and a beetle, *Himatismus fasciculosus*, Pér. The weevil was carried to a drive at once. The bugs caused

delay and were carried hither and thither a little, but finally brought to the main track and taken to a drive. When I last noticed *Himatismus* it too was being dragged along. I then put in eight *Antestia variegata* and eight weevils. All were seized—it was impossible to see whether one was preferred to the other—and carried along.

I now went back to Column 1. It had moved on to some extent, and a number of its members were busy exploring, and apparently enlarging, a vertical hole in the ground, out of which I saw them bring up three white bee larvae. A number of large guards were stationed in a mass over the hole, and a thin stream of ants passed between these and the bank. On the other side the stream was thinner still. I put an *Antestia* on each side. That away from the bank was once or twice attacked half-heartedly and was inspected by a number of passing ants, but on the whole left alone. Very different was the treatment accorded one of the bee grubs. I placed it beside the bug, and it was at once seized and carried off, several ants joining in. The bug continued to be ignored. The other bug, however, had been seized and carried to the mass of guards. One of these seized it, and straddling over it carried it back the way it had come, and finally disappeared with it into the hole in the bank.

Returning to Column 2 I found the *Epilachna* and *Mylabris* still in the same place, and I was just in time to see the last bug and the last weevil disappear into the drive. I should have said that before I left, the *Epilachna* had more than once escaped, practically unmolested, from the ants, but that I had each time put it back. I now put in five fresh *Mylabris amplectens* and a smallish *M. oculata*. Considerable excitement ensued amongst the ants, and the beetles were being dragged hither and thither, when a large reinforcement, including a considerable proportion of the largest workers, emerged from one of the drives, and, seizing the beetles, including the *Epilachna*, carried all along, often with a great deal of delay, into the opposite drive. One beetle only withstood the attack, and that was the original *Mylabris amplectens*, a very large specimen. It was attacked like the others, but relinquished, attacked again and again, left, and so on, until at the end it was not much nearer the opposite drive than it had been before. The *Amauris* larva, the remaining *Acraea* larva and the fly, which I put in once more, were treated

much as on previous occasions, and finally left high and dry. But the rush was already lessening somewhat by the time they were inserted, and a little later, when the column had subsided to its normal dimensions or rather less, it took very little notice of three more coffee-bugs and soon abandoned them completely, though a small Elaterid was at once seized and hurried along to the opposite drive.

Meantime, the other party had established better "through" communications once more, and though comparatively few in numbers seized and carried off into the bank eight coffee-bugs, three weevils and a *Harpactor erythrocnemis* (also taken in coffee), though still ignoring to the same extent as previously the *Amauris* larva and the fly. They attacked a small *Mylabris amplectens*, but eventually abandoned it.

Later, having captured a fine ♂ *A. areca*, I returned the *Amauris* larva and the fly to Column 2, where a large number of ants were passing. Both were treated as before. Two Epilachnas were attacked, but eventually abandoned and gradually allowed to escape; the original *Mylabris amplectens* was still present, drawing an occasional slight attack, but was mostly left alone; a dead *Dorylus* was ignored for a while, but then picked up by one ant and carried along; the *Acraea* larva was attacked, but allowed to escape. Afterwards, as it was moving along parallel with the column, I was amused to watch it meet a large number of ants. As each stopped and felt it with its antennae the larva would stop dead. When the ant moved on, as it invariably did at once, the larva would move on too. There was no further attempt at an attack. A small piece of banana pulp that I put down was attacked, several ants making off to the drive with portions of it, and an ordinary cattle tick (*Rhipicephalus* sp.) was seized and carried to a drive, but not until it had inconvenienced its carriers very greatly (three in all carried it, but only one at a time) by getting under them and clinging to their legs. A coffee-bug was seized and carried along. Then *A. areca*, with wings shorn $\frac{1}{3}$ of the way up and exuding juice, was placed amongst them. Even in this condition it was too active for them, so I killed and returned it, when it speedily became a seething mass of ants. I put down just afterwards an *Amauris albimaculata* with its wings attached and a coffee-bug. The latter appeared

to be attacked somewhat less readily than the two butterflies, but once definitely seized was carried along fairly fast; the *Amauris* was dragged wings and all, and, considering that it made a broad and heavy load, proceeded with considerable speed. It was at the hole and in process of being diswinged there before the *A. areca* had travelled more than three or four inches. I had noticed at first three or four ants withdraw on coming into contact with the liquid exuding from the nervures of the Acraea's wing-stumps, but the butterfly's juices, though normal in quantity, were either insufficient or not unpleasant enough to keep its enemies off. At this moment a fresh rush occurred, and I at once returned the two Epilachnas, the *Mylabris*, the two larvae and the fly to the main track. The two ladybirds were at once carried off into the drive, as was, after more in the way of hesitation and temporary abandonments, the *Acraea* larva; the *Mylabris* was carried to the mouth of the drive, but as I saw him crawling about that neighbourhood half an hour later was probably abandoned there or just inside. Considerable disinclination was still shown to attack the *Amauris* larva, and it was only by moving it frequently in their midst that I irritated them (for that I presume was it) sufficiently to make them really attack it. When they did, they attacked with the utmost ferocity, and having killed or practically killed the larva, carried it along to the drive. I rescued it at the last moment, wishing to use it further. It had this time emitted no dark juice.

Similar, if not greater, disinclination was shown to attack the fly, but finally this, too, was seized and carried along by one big warrior. It was still a considerable time before the *A. areca* reached its destination, and was there broken up and carried in, but there was never any abandonment of it; it was always covered with ants.

At about this stage I again put in the *Amauris* larva, and, on the magnifying glass to which it was attached a freshly pupated individual of *Amauris albimaculata*, somewhat crushed accidentally. The ants refused the larva, and though numbers swarmed upon the glass to the pupa all retreated on coming into contact with either it or its fluid, and no attempt was made to carry if off. I tasted the fluid; it was to me reminiscent simply of raw leaves of no very definite kind.

Later, having again ascertained that the ants would not

touch the *Amauris* larva, though an imago of the same species was at once carried along, I interrupted the column by placing in its midst a rather spread-out mass of not less than 200 coffee-bugs thoroughly mixed up with about a third of that number of the weevil *Systates* and a few *Himatismus*. Half an hour later the pile had been reduced by about half, the ants taking the insects as they came from the outside and not choosing between weevils and bugs. An hour or more later, by lantern light, I found the column reduced to almost nil and the bugs to between twenty and thirty. They were somewhat scattered and more or less piled up between with loose earth and *Acacia* leaflets, a very scanty layer, however. No weevils or *Himatismus* were left. I inserted an *A. albimaculata* and a *Leuceronia thalassina* ♂, but the few smallish ants that were still using the track took no notice of them, beyond stopping to inspect *en passant*. Shortly afterwards I noticed that a fresh track had been made alongside the old one, and more ants were passing along it. The old one with the butterflies still in it was now quite deserted. I placed them together in the centre of the new track, about equidistant from each drive, and saw both seized. On returning a few minutes later I found them being dragged in opposite directions. The *Leuceronia* was going at unmistakably the better pace and had already practically reached its goal; the *Amauris* with about the same number of ants was barely half-way. Now, ten minutes later, as I am about to go to bed, the *Amauris* has only proceeded about two inches further. I had removed the *Leuceronia* on my last visit, wishing to use it further; it was then within an inch of its hole. The ants had made no attempt to strip the wings off either.

April 27th, 1911.—I looked once more, for the last time, ten minutes after the above was written. The *Amauris* had only proceeded another two inches in spite of the fact that since I removed the *Leuceronia* the number of ants engaged on it had more than doubled. They seemed to be spending as much of their time in feeling over the surface of the butterfly as in carrying it. The bugs, though a number of ants was passing round them, were being completely neglected.

This morning the wings of the *Amauris* were lying just outside the drive.

Later: Found this afternoon where the above drive

emerged, ten yards away, four or five of the bugs lying abandoned though continually passed by the ants. At the spot experimented at yesterday the 20–30 bugs are still lying untouched, though a large stream of ants is passing them. I put in a *Rhodogastria bubo*, just captured and commencing to exude froth. It was at once seized by the legs and commenced to froth most lavishly; but though the froth certainly discommoded such ants as came into contact with it, it was confined to the thoracic region, and the rest of the moth was quickly covered with its enemies. Also, in its struggles, the mass of froth was quickly knocked off and no more was forthcoming. I rescued it at this point and had to pick a large number of drivers from its legs.

On the coffee-girls bringing in their daily kill of bugs (*Antestia variegata*) again this evening, I placed a few in the ant-column close to where the remains of yesterday's still remained untouched; also an *Epilachna hirta*, just captured. The latter only was attacked, but never seriously, and was twice allowed to escape. I noted that such ants as came into contact with the protective fluid drew back slightly, but I also noted once more their failure to grasp or pierce its glossy elytra with their jaws. It would be interesting to see whether the fluid without the glossy hardness of the beetle's exterior would be a sufficient protection.

On, I think, the following day—April 28th—I found large numbers of *Antestia* thrown out of the drive, at the mouth of which four or five were lying on the 27th. None of the beetles taken with them had been thrown out.

May 12th, 1911.—A column of *Dorylus* was busily exploring the recesses of an old post to-day, and dragging out thence the larvae of wood-boring Hymenoptera. I placed in their midst eighteen full-fed cattle-ticks (*Rhipicephalus*, sp.). They were at once smothered in masses of the ants, but fifteen minutes later, though still lying in the midst of the column, they had been abandoned completely. They were apparently undamaged. One of my ground-hornbills (*Bucorax caffer*) stalking along shortly afterwards ate them all, but took no notice of the drivers.

Yesterday when I was cutting up a sheep, and throwing an occasional waste bit to the hornbills (*Bucorax caffer*), I threw one such piece into the midst of a column of

"drivers." It was at once covered with the ants, but a hornbill at once strode up, picked it out and, after shaking off only a few of the ants, swallowed it with all the rest that were clinging to it.

Remarks.—The ants were unconfined, carrying on their ordinary daily avocation. The experiments cannot therefore be criticised as having been carried out on animals under "highly unnatural" conditions. Yet the ants showed strong "preferences," readily taking some animals when they would not take others at all, and when failing in their attacks on yet others. It is true that some of the winged insects offered were, because winged, not such as the ants would normally have an opportunity of seizing except when hunting at night—but they do hunt at night greatly. Most of these were nevertheless taken by them, and, even if we should exclude these as not forming a part of the ants' normal food, we should find that a number of species were offered that the ants must meet with continually, and that very strong "preferences" were shown even as between these.

The butterflies tested, the moth *Rhodogastria bubo*, the larva of *Papilio demodocus*, a hive-bee, the larvae of a bee and of a wood-boring Hymenopteron, a cockroach, the beetles *Himatismus*, *Systates*, and an Elaterid, and a *Zonocerus elegans* were probably all less protected from *Dorylus* than even the weakened larva of *Aletis monteiroae*, and certainly than the larvae of *Acraea acara*, than adult *Mylabris amplectens*, *Epilachna polymorpha* and *E. hirta*, and *Antestia variegata*, and all these, apparently, than the fly, the larva and pupa of *Amauris albimaculata* and the beetle *Psammodes* (protected by hardness). But the ejection from the tunnel of a large number of *Epilachna* a day or two after they had been taken in may indicate that these were found to be as bad as any of the objectionable species. Certainly the ants found the fly and the Danaine larva and pupa much more *obviously* unpleasant than the Epilachnas, *Mylabris*, *Antestia*, and *Acraea* larvae, and it is clear from an experiment to be described below that the latter when well-grown are acceptable enough to them if they give the ants time, and the latter are persistent enough, to raze the juice-dealing hairs.

The butterflies used were *Danaida chrysippus*, L., *Amauris albimaculata*, Butl., *Mycalesis campina*, Auriv., *Acraea neobule*, Dbl. and Hew., *A. egina*, Cram. var. *areca*,

Mab., *Acraea natalica*, Boisd., *Byblia ilithyia*, Drury, *Mylothris rueppelli*, Koch, a *Belenois*, *Leuceronia thalassina*, Boisd., *Papilio echerioides*, Trim., and *Rhopalocampta libeon*, Druce. It seemed that the Acraeas gave a little more trouble, with their juice, than did *Amauris* with its pungent smell, yet this did not save them even for a moment. That *Amauris* in time may have been better protected than *Leuceronia* (and probably others) seemed to be suggested by the slowness with which the ants would progress with it, "spending as much of their time in feeling over the surface of the butterfly as in carrying it." The froth-masses of *Rhodogastria bubo* and the bay-leaf-scented filaments of the larva of *P. demodocus* were only momentarily and locally deterrent, and the sting of the hive-bee not at all. The *Zonocerus* with its (to us) nauseous smell and its ill-effects on vertebrates eating it, was naturally more slowly dismembered than the smaller species used, but that was all. Quite unprotected also, apparently, were beetles *Himatismus*, *Systates*, and the Elaterid, the cockroach, the hymenopterous larvae, and adult *Musca domestica*. A hungry cattle-tick was taken, though full ones, on another occasion, were all refused; but a very interesting incident in the experiments that follow should be seen in this connection.

The acceptance of vegetable-matter (banana) was interesting, as was the fact that even partly-disabled Acraeas—not the most active of butterflies in any case—were able to escape for a time from the drivers. With power of flight they should never be taken except when asleep. This consideration, with the *special* repugnance shown to eggs and very young larvae in the experiments still to be described, suggests a very beautiful instance of the probably universally obtaining principle of compensation and complementation and of the fact (implied therein) that an animal's defences may vary greatly at different stages of its existence, one defence being donned in proportion as another is doffed, and *vice versâ*. Thus in both *Acraea* and, say, *Papilio dardanus*, numbers and intrinsic nauseousness, at their height in the egg-stage (assuming the experiments to be reliable), and then most necessary, are gradually exchanged, in the first case for an ever-growing supply of protective fluid, in the second for an ever-increasing procryptic element in the coloration, this culminating in the extraordinarily complete resemblance

to a growing Rutaceous leaf displayed by the pupa. Each emerges. The *Acraea*'s fluid-supply has been much decreased, yet is efficient enough in relation to present enemies, and its flight is sufficient to commonly save it from the driver. The *Papilio* has flight, and, instead of a protective fluid, has polymorphic mimicry in the female (compensated in the male by better flight and slightly greater nauseousness), and a strong procryptic element in the "matching" of the dulled underside by both sexes in resting. I have already mentioned the native view of nestlings, and I am publishing elsewhere ("Ibis") the results of some actual experiments with birds' eggs: a stronger procryptic element, represented most usually in the *nests*, is present here than in the case of butterflies' eggs; also parental protection; so that nauseousness is to a varying extent less necessary, though it is often, I believe, in some degree present to complement or replace these other defences. Those plants in which the seedlings are less liked by herbivora than is the adult foliage (protected by height, etc.) afford a somewhat closer parallel. though they trust more than even butterflies to their reproductiveness. It would be very interesting, in view of recent observations that have discredited the view that it is myrmecophilous, to ascertain whether the bull's-horn thorn acacia of America is not one of them.

Further interesting points in the experiments were: (1) the effect on survival of, *apparently*, variability in juice production or conservation in individuals of *Mylabris*, one such individual, a large one but amongst the first to be inserted, remaining protected to the end, while others were taken and one was definitely exhausted of juice and killed; (2) the shearing of the spines of *Acraea acara* larvae. This was improved on in a subsequent experiment in which the juice was absorbed by the application of earth-crumbs. I have on a few occasions seen *Acraea* larvae feeding with similar earth-crumbs attached to their bristles, and there can be no doubt that the ants' successes against Acraeine larvae in these experiments were mainly due to my replacing the escaped larvae amongst them time after time; (3) the behaviour of an *Acraea* larva meeting successive ants, then not prepared to attack it; (4) the ants' *general* variability as to the food they would accept, rather surprising and reminding one somewhat of the different stages of hunger in a bird; (5) the release

of a *Mylabris* from a drive into which it had been carried, and the ejection, long after taking, of a number of *Antestia*; (6) the apparent failure to grasp glossy *Epilachna*—yet on one occasion some were carried off; (7) the earthing or leafing up of highly unacceptable objects (for the treatment of Acraeine eggs in the same way see below). One felt that it *ought* to have been for visual effect, yet of course it could not have been. The leaflets and earth-crumbs may have been specially scented by the ants, but why should it not have been sufficient to do this to the animal itself, as was apparently done in the tick-incident yet to be described? Experiments of this kind lead one to wonder, throughout, at the completeness with which other faculties are capable of taking the place of vision.

At any rate several animals—the fly, the larvae of *Acraea* and *Amauris*, the pupa of the latter (which was highly interesting), adult *Mylabris*, *Epilachna*, *Psammodes* (through hardness) and *Antestia*, all of them (unless *Antestia?*) with habits that place them at the mercy of *Dorylus*—probably the greatest scourge of relatively low-dwelling insect-life we possess—proved to be highly protected against it; and *Dorylus is* such a scourge that its attacks and its failures may reasonably be regarded as having aided appreciably in the selection (to their present high pitch) of these insects' protective qualities.

Of the potential prey itself, it is sufficient to say that all the animals just named except *Antestia* are highly sluggish and indifferent to attack. *Antestia*, our greatest coffee-pest, less so. It possesses a strong "bug" smell, and is conspicuously coloured, but it drops and flies and dodges round twigs somewhat readily. Even so, it is not very hard to catch, my coffee-girls bringing in great numbers daily when destroying them by hand-picking. It probably has special enemies: one of my tame but unconfined ground-hornbills (*Bucorax caffer*) once ate 193 in quick succession, and "capped" them with an *Amauris albimaculata*. We have also seen in the present experiments how *Dorylus* accepted them relatively readily, once in large numbers, though it subsequently did eject them.

In general, given that *Dorylus* readily accepts insects as low-grade as the *Acraeinae* and *Danainae*, the ants' acceptances and refusals come in line with those of my birds; for the latter too placed these butterflies above,

e. g., *Epilachna* and the larvae of *Acraeinae*, of *Danainae* and of certain other butterflies. This, on such general considerations as I have alluded to above, is only what one might expect. What, on those same considerations, one would *not* expect is that *Zonocerus* and *Rhodogastria*, both far more sluggish and apparently helpless than any of our *Danainae*, etc., should have been as readily accepted by the drivers, and placed slightly *above* the *Danainae* and *Acraea areca* by my birds.

2. Experiments with Insects' Eggs

April 28th, 1913.—A horde of the driver-ants had retired in the evening into their "drive," but at every opening there were warriors standing sentry with up-raised open jaws, and a few ants were walking about aimlessly or resting. I put down four eggs of *Acraea caldarena* attached, as laid, to a small scrap of *Wormskioldia* leaf. They were closely inspected by several ants, but no attempt was made to take them. I then added an egg of *Papilio dardanus* ♀ f. *hippocoon*. This attracted less attention: one warrior took it listlessly in his immense mandibles and, as I found afterwards, must have used just enough force to separate it from its leaf (*Teclea*), then left it without having damaged it. An egg of *Pseudacraea lucretia* var. *expansa* was also ignored.

April 29th.—This morning I visited an active column of *Dorylus*. The ants were keeping to their narrow-column formation and travelling rapidly, mostly in the same direction. I put down three eggs of *Acraea aglaonice*. These were examined by many ants but not attacked, and soon became shifted to the side of the column, amongst the guards. I then put down two eggs of *Pyrameis cardui*. The ants took absolutely no notice of these, merely scurrying over them, and they too had soon found their way to the side. A *P. hippocoon*'s egg followed. It remained unheeded too, but it formed a good-sized obstacle, and soon a passing ant picked it up and deposited it outside, then returned to the column without it. Two more eggs of *P. cardui* followed the example of the first two. All eggs in this experiment had been separated from their leaf before being offered. Were the eggs all definitely unacceptable to the ants? Were they too small to be worthy of notice? Were the ants too busy otherwise

at the moment to take notice of food? or (an unlikely supposition) were the eggs (one of which had been treated as an obstructing pebble might have been) regarded as of the mineral or vegetable kingdoms? I returned to the house and cut up a small piece of meat into scraps as small as a *P. dardanus* egg, and twenty minutes later returned to the ants.

The meat scraps were becoming dry. I put one in the track, and it was at first passed over, then seized and thrown outside as the *dardanus* egg had been. A second piece was treated in the same way. But a moist, freshly-extracted egg of a smallish, dull-coloured grasshopper was at once picked up and carried along, as was a freshly-cut-off piece of meat four times the size of a *dardanus* egg. But a similar piece of half the size was thrown outside! However, on my returning it, it was at first for a time passed by, then an ant took it and kept with it in the column. An egg of another species of grasshopper was set on to by three or four ants, and it was some time before one of them finally carried it along in the column. I then crushed and put in together three eggs of *A. acara*. They were picked up and carried along. To test what the ants were prepared to rise to in the matter of unpleasantness I next placed an adult *Acraea terpsichore*, L. (the only *Acraea* I had with me), first killing it, three or four inches from the column. It was quickly found, a mass of ants covered it up, the wings were gradually taken off at the base and the body brought into the column and carried along.

May 1st.—Again tried *Dorylus*—yesterday's column, as active as previously. I put in in turn slightly developed, unbroken eggs of *Papilio dardanus*, ♀ f. *hippocoon*, *Papilio demodocus* and *Pyrameis cardui* (four or five of this). They were in each case either completely ignored or merely picked up and dropped outside. Eggs of *A. acara* and *A. aglaonice*, put down two or three together, were completely and continuously neglected. I watched for quite half an hour, occasionally moving the eggs back into the run, but nothing other than what I have described occurred. But an egg of *Charaxes ethalion* (new-laid, plain green and not yet ringed) almost immediately found a carrier, and was taken along to the next outpost in the direction in which the main body was moving.

Two eggs of *hippocoon* extracted from the body of their

parent and placed still wet in the run attracted much more attention. Many ants examined them and some went so far as to enclose one or other with their mandibles, but each time at once desisted and went on.

After waiting for some time longer I collected all the eggs, then broke slightly two or three eggs of *A. aglaonice* and put them in together. They were largely ignored, but occasionally examined, and they found no carrier. A similarly-prepared *P. demodocus* egg was treated in the same way and of the two extracted *hippocoon* eggs one eventually found a carrier, being taken by a small worker with immense difficulty *against* the main current right back to the station the latter was leaving, nearly three yards off. An interesting incident occurred at the outset—all the more interesting because the ant was sightless : she had the greatest difficulty in making any headway, and eventually dropped out to the side and, waiting till three or four large ants with good-sized loads came along in the desired direction, fell in behind them. She was unable to keep up with them for very long, but eventually reached her goal. The other extracted *hippocoon* egg was finally picked up and thrown outside the column. Eggs of *P. cardui* (three or four partly broken and forming one mass) were examined, picked up and carried along, but two unbroken eggs of *C. ethalion* were ignored (as were, still, the broken eggs of Acraeas, etc., the treatment of which I have just described). On being broken, however, the two *Charaxes* eggs, one new-laid, the other already with a dark apical ring, each quickly found a carrier. A large adult male *Acraea doubledayi*, killed by myself and placed outside the column, was overwhelmed, diswinged, and carried away.

I added more *Pyrameis* eggs, but the rush of ants was now very great, and it was possibly for this reason that the eggs were continuously overrun, apparently unnoticed. So I turned my attention to one of the side columns. Here eggs of *A. aglaonice*, broken together, received a great deal of attention but found no carrier; a new-laid egg of *C. ethalion* was soon picked up and carried by a side connection into the main column; eggs of *A. acara* were treated exactly as those of its congener had been, but three or four *P. cardui* eggs were picked up together and carried to the station ahead; an egg of *P. demodocus* was treated as the *Acraea* eggs had been, but a semi-

incubated *ethalion* egg found a carrier. Thinking I might have crushed the *demodocus* egg so much as to render it unattractive by loss of contents I added another of the same brood very slightly crushed (in each case by pressure of a pin-point). This too was much examined but not taken, and one ant picked it up and dropped it outside the run. On my returning it, the egg was treated as before, but eventually an ant carried it for about eight inches, then once more deposited it outside. The *Acraea* eggs also remained untaken all this time, though frequently examined, but, on my putting down two *Pyrameis* eggs with a third of the same species crushed against them, they (the *Pyrameis* eggs) were picked up by a small ant and carried forward to the station. A further batch of two or three *Pyrameis* eggs was ignored, and the next half-incubated *ethalion* egg was examined by two or three ants and neglected. Whether these eggs would have continued to be neglected I am unable to say, as I had now to discontinue the experiment.

This description gives no real idea of the tediousness of the experiment, which lasted about two hours. In almost every case the egg was passed over by far more ants than noticed it, and the difference between the eggs of the Papilios and the Acraeas on the one hand and those of the two Nymphalines on the other, was that whereas the former were very frequently examined they remained untaken to the end, while the *Charaxes* and *Pyrameis* eggs were picked up and carried by the first or nearly the first ant that stopped to notice them.

I should say the *C. ethalion* eggs found carriers more readily than *Pyrameis* eggs. I was unable to find, for the broken-egg experiment, the half-incubated *hippocoon* egg I had used previously.

In view of *Acraea* eggs having been accepted the day before yesterday, their rejection in this experiment requires confirmation.

[On leaving the ants I found a medium-sized cattle-tick (*Rhipicephalus* sp.), and going back put it in the run. Some ants ran over it without stopping; one or two halted and examined; then one took it by the side and retiring to the side of the column held it there, merely preventing it from moving away, herself in meantime lying over on her side. As the stream of ants went ceaselessly past a number of its members—one at a time, two at a time, or

several at a time—would fall out, examine the tick well and then pass on. The examination frequently ended up with the adpression of the end of the ant's abdomen to the surface of the tick. I had previously seen them do this to some of the eggs when examining them, and once one ant did it to another. I watched the performance for quite fifteen minutes, and it was still going on when I left. Was it a demonstration to the younger generation of the distinctive characteristics of Mr. Tick? Or were they submitting their opinion of him? Or was he merely being detained until some official of the tick department should come along and take charge? !]

In the latish afternoon I returned to the spot and put down in turn in one of the smaller side columns the eggs (well-punctured) of the following butterflies :—*A. caldarena* (two lots of three or four each); *P. dardanus hippocoon* (two); *P. demodocus* (one); *P. cardui* (four, forming a single mass); *Eurytela hiarbas* (one); *Hypolimnas misippus* (two); and two *C. ethalion* (unusually small and yellow, not green, and with a very narrow ring). Throughout the experiment, which lasted a considerable time, I saw no notice at all taken of the hairy egg of *E. hiarbas*—it merely became automatically pushed out to one side each time I returned it to the column. I forget whether I saw the *Pyrameis* eggs definitely inspected—at any rate, they found no carriers and met with the same treatment as that of the *Eurytela*. At least once an *H. misippus* egg was inspected, but neither was taken. The *hippocoon* and *P. demodocus* eggs were always carried outside, never along, and at first the same was done to the two *C. ethalion* eggs. Seeing this, I added a green *ethalion* egg of the brood from which I had used in the morning. This quickly found a carrier. I added yet another and an egg of *P. lucretia* var. *expansa*. Each was shortly thrown outside, but only a few minutes later the *Pseudacraea* egg was again picked up, and this time carried right on to the next station.

The *A. caldarena* eggs were sometimes inspected and always refused, and so were some *A. acara* eggs that I now added, together with two more eggs of *Pyrameis* and another of *P. lucretia*. The *C. ethalion* eggs were being frequently inspected and occasionally picked up, but none were carried away, and once an ant, having inspected and refused one of them, passed on to the *P. lucretia* egg close by (it had been put outside the column by an ant which

had come into contact with it), and, after examining it, picked it up and carried it along with the column to the station ahead. I now put down close beside each other ten punctured eggs of *A. acara*, already turning purplish brown from incubation. My putting down so many in quick succession disturbed that portion of the column, and there was a very slight movement out in my direction, during which a number of ants came into contact with *Acraea* eggs and inspected them, in every case briefly and with rejection following. Two or three of them now set to work and placed small pieces of earth on top of the eggs, a good-sized piece of dry grass-blade crowning all. This has only been done in my previous experience to the most highly unacceptable of prey, and it constituted, I believe, the best possible evidence of the ants' definite repugnance to the eggs. After they had been thus branded, the eggs, though still visible to myself, were no longer, so far as I saw, the subject of examination. About this time the green *C. ethalion* egg found a carrier. Rather earlier in the experiment the *P. demodocus* egg was taken up, though lying outside the column, by an exceptionally small ant. The nearest sentry at once came up and inspected, and before the small ant finally got well away the egg twice or thrice became the object of inspection for three or four ants at a time; but she finally went off with it with the column.

I now left for half an hour. On my return things were much as I had left them, and none of the *Acraea* eggs had been moved. I decided once more to test the view that it was merely the small size of the eggs that was against them. I accordingly cut up two house-flies (*Musca domestica*) into fragments not larger than a *Papilio* egg (for example, the two eyes each constituted a different offering), and placed them in and near the run. Each piece at once became the prey of *several* ants, not merely of perhaps the fortieth chance passer-by as in the case of the accepted eggs, and all were quickly carried off. I added, each separately, the two eyes of a ♀ *A. caldarena*, and these were also taken. I then extracted its eggs (there were not very many) and laid them down as three or four little separate masses. The ants swarmed over them as over the previous offerings, but very speedily desisted and quickly covered them with small scraps of earth, after which they were persistently neglected. I

noticed too that the earliest eggs in the experiment—the *laid* eggs of *A. caldarena*—had, earlier, also been placarded in the same way. I then laid down, in three pieces each, the abdomen and thorax of the *Acraea*. These were seized by quite a number of ants, as was a whole, wingless, dead *A. caldarena*, but were not carried far, each being abandoned after a trip of a few inches. They were not placarded, at any rate to any noticeable extent. In the general bustle the earlier *caldarena* and *acara* eggs became uncovered, and they and at any rate the larger of the remaining eggs came in for a good deal of additional attention, and the remaining green *ethalion* egg was quickly carried off, as also one of the yellow ones. One *hippocoon* egg disappeared now or earlier, but may of course simply have become hidden by loose earth; the other remained untaken throughout and eventually fell into some debris in a rut, and I was unable to recover it. I saw none of the small Nymphaline eggs taken, and was able to find more than half of them at the end. I added a *P. demodocus* and a *hippocoon* egg during the bustle, and these were after much delay taken, and an egg of either *Charaxes brutus* or *C. cithaeron*, which was visited by many ants, and though a relatively large and conspicuous object and brimming over with liquid was each time merely tried and left. A green *C. ethalion* which I added to it was taken practically at once, and eventually the larger *Charaxes* egg found a carrier too. The uncovered *Acraea* eggs found many visitors but never a carrier, and on my visiting the ants again the last thing in the evening remained uneaten and had been partly earthed up again.

Before discontinuing the experiment I had added one or two small, black orange-Aphides by themselves, and, in a mass on the twig on which I found them, a large number of others. They attracted a great deal of attention, but I was unable definitely to see that the ants "milked" them at all, as do some of our other ants, but a few of the usual warning earth-crumbs were placed on them.

May 2nd.—During the morning, again going to yesterday's side-column, I placed by it several eggs of *A. caldarena* and *A. acara*. They were subjected to a great deal of inspection, and finally earthed and neglected. A *Danaida chrysippus* egg which I placed right in the ants' path was inspected by very numerous ants but always at once

refused. Eggs of *hippocoon* and *P. demodocus* were usually given longer consideration by the ants that stopped at them and, especially the latter, sometimes picked up, but were not taken. Of two *H. misippus* eggs only one, so far as I saw, was properly inspected, and it was refused. An egg of *E. hiarbas* was once or twice inspected and once picked up and put outside but not taken, and two or three eggs together of *P. cardui* were rejected. But a *C. ethalion* of yesterday's yellow brood was at once picked up by the first small ant that came to it and carried away. The larva, only just hatched and not yet having eaten, of *hippocoon* was passed over for some time and several times inspected and refused, but finally an ant took it and held it in one place for two or three minutes while passers inspected it (as in the case of the tick) before she finally commenced definitely to carry it. She was even then very undecided for a time, sometimes going on towards the next station ahead, then retracing her steps and going towards the main column and so on. Finally, she took the latter direction.

I kept moving the rejected eggs back as they became pushed or carried to the side, but without effect, though a fresh green *C. ethalion* egg that I added to them was at once taken and carried, and eventually an ant took the *P. demodocus* egg and, after what looked like much consultation, carried it off too. I now turned my attention to the main column, which was going strong, nine or ten abreast. I put in the *Danaida* egg. It was inspected and at once rejected by several ants, and at last put out to the side and well earthed up. A *P. dardanus hippocoon* egg was twice ejected, two eggs of *A. acara* were ejected after having been the subject of much inspection by individual passers-by, and earth-crumbs were placed against them. But a yellow *C. ethalion* egg was quickly picked up and carried to the nearest station.

On my bringing *Danaida* to the more active attention of the ants it was several times tried with the antennae and refused, the *hippocoon* egg, as well as a second that I added, was persistently ignored or ejected; the *P. demodocus* egg was tried and refused a few times, then found a carrier; of two *P. cardui* eggs put down, one was picked up very soon and carried along, the other remained ignored and possibly unnoticed; two eggs of *H. misippus* placed amongst the ants were overrun and gradually

drifted to the side every time I brought them back. I did not see them tried. An *E. hiarbas* egg was picked up and ejected, as was, several times, an egg of *hippocoon* and one of *P. demodocus*; but a green egg, with dark ring, of *C. ethalion* was very soon picked up and carried with the column. I then killed, diswinged and put just inside the column a ♂ *D. chrysippus* and a ♂ *Acraea natalica*. Each was at once covered by a mass of ants and gradually brought into the line. Proceedings continued to be so slow that I had to leave, but on my return to inspect half an hour later or less both had completely disappeared.

May 2nd.—Afternoon.

This was really a larva experiment, but as eggs were used too, and as the use of freshly-hatched larvae is also obviously relevant, I ought perhaps to state the gist of it here.

Eggs of *A. acara* many times refused, one each of *hippocoon* and *P. demodocus* two or three times ejected, a just-hatched *P. dardanus* larva treated as in the morning, but a three-quarter-grown one with the final, most protective appearance at once set upon and carried off. Barely hatched *A. acara* larvae, still busy with their egg-shells, persistently refused and repeatedly ejected, but a half-grown individual of the same species killed and taken, as also quarter-grown *E. hiarbas* and *A. caldarena* larvae and a nearly full-grown *A. caldarena* larva.

The larger *Acraea* larvae gave the ants a good deal of trouble by exuding, when set upon, drops of the usual poppy-flavoured liquid from the ends of their bristles. They thus succeeded more than once in escaping from the column. I put them back, however, and the ants overcame the difficulty intentionally or incidentally by placing on the ends of the bristles crumbs of dry earth, which soaked up the liquid and enabled them to bite off the bristles lower down. Fresh drops appeared as the result of this, and fresh crumbs of earth were applied until finally the bristles were razed off level, in many cases, with the caterpillar's body. It was then set upon freely by masses of ants, killed and carried off. I at first believed that the application of the earth-crumbs was purely in the nature of "placarding" (which is still possible), but I felt before the end of the experiment that it might readily be, as I have described it, for the purpose

of soaking up the liquid. I hope to repeat the experiment. The greater repugnance shown for the very young larvae is of great interest. It is in line with the dislike shown for the eggs, and perhaps explains the greater conspicuousness of certain newly-hatched larvae — for instance, those of *Papilio dardanus*. It is also in line with native statements about nestling birds (alleged to be in general less pleasant to eat than the adults), though this has not been proved to apply to other enemies than man.

In a weak column of ants elsewhere I had tested a few days previously larvae of *Acraea caldarena* (from a quarter to nearly full-grown) against larvae of *Precis natalensis* of the same sizes, also against a dull-coloured spider that I happened to catch on the spot. The *Acraea* larvae escaped by the use of the fluid secretion, but the *Precis* larvae and the spider were killed and carried off.

May 3rd.—Put down an *Atella phalantha* egg. Numbers of ants passed over it, but none stopped to examine. Finally it suddenly disappeared. It must, I think, have been picked up, but whether thrown out or carried along I could not ascertain. A second was for some time passed over unheeded in the same way, until suddenly a small worker picked it up, dropped it quickly just outside and passed on again. On my returning it, the egg was again passed over as before and remained untaken when I had to leave, a few minutes later.

May 6th.—Put down two eggs of *Charaxes candiope*, already lightly ringed. They were passed over and examined and neglected by a number of ants, until finally an ant examined one of them thoroughly, picked it up and going a few inches down the column turned into an out-jutting "creek" (so to speak) of ants, scrambled in amongst the others, possibly consulting, came out again and a few inches back the way she had come, then back again into the little conclave, out again and back yet again. On her emerging this time my attention was diverted to a prolonged examination that was taking place of the second egg, and I could not again trace the first, so am unaware of its eventual fate. I added two more *C. candiope* eggs to the second (the examination of which had ended in ejection from the column), also two eggs each of *P. demodocus*, *Atella phalantha* and *hippocoon*, and four or five (together) of *A. acara* (dark with incubation). I

watched for a long time and, though many examinations and one or two apparent consultations took place, none of the eggs were taken, and the larger ones usually ended in being ejected each time I put them in. I then put down an egg of *C. ethalion*, with a ring and slightly incubated. It was very soon picked up and carried along to a tunnel, but a second of the same date received much the same treatment as the other eggs.

The above took place in the orderly bustle of a marching column. I next went to the head of a column some distance away, where the ants were well scattered out over a wide area, searching, and put down on a stone they were crossing two eggs of *C. candiope*, one of *hippocoon*, one of *P. demodocus* and one of *A. phalantha*. They were many times examined but never taken. I added an egg of *C. ethalion*, and after being examined and left, like the others, a few times, it was picked up and carried for a distance, then put down. On my replacing it, this egg (and none of the others) was soon picked up once more and carried away. I now kept trying to bring a *C. candiope* egg to the notice of the ants and it was always refused though often examined, but a *C. ethalion* (very hard-set) was then treated similarly. There were very few ants here now, and I next went on to experiment at a spot where they were covering the ground fairly thickly, and put down an egg of *C. candiope*. This was set upon by several ants, but they shortly desisted and left it, and treated similarly two more eggs of the same species. A *P. dardanus hippocoon* egg, a *P. demodocus* egg, an *A. phalantha* egg and eggs of *A. acara* were also all refused, as was the about-to-hatch *C. ethalion* egg. The ants were already becoming thinner again at this point, so I moved the eggs and added a fresher *C. ethalion* egg, marking the place. I left, and returned ten minutes later to find that the ants had shifted on again, leaving all the eggs as they had been put down by myself.

I decided at this point to discontinue the experiments. I had not the animals for the far more extensive series of experiments that I still hope to undertake, and the ants' reply to the question asked of them had been in any case of a sufficiently consistent nature so far as they themselves were concerned. In spite of their rather catholic tastes, they had evidently found all the eggs offered them—at all events all they definitely tried—rather highly un-

acceptable, but not quite equally unacceptable. I am inclined to state as follows the grades that were indicated :—

(1) *Pseudacraea lucretia* var. *expansa* and *Charaxes ethalion*.
(2) *Papilio demodocus*. } *Charaxes cithaeron*.
(3) *Papilio dardanus*. }
(4) *Acraea acara*, *A. aglaonice*, *A. caldarena* and *Danaida chrysippus*.

Pyrameis cardui eggs would appear from at least one experiment to be preferred to those of *P. dardanus*, but they cannot, I think, be very *much* higher. *Hypolimnas misippus* and *Eurytela hiarbas* eggs would appear to be as low as that of *P. dardanus*, but the extent to which they were genuinely tried seems doubtful.

The eggs tested cover quite a considerable range of appearance, and this, with the fact that when we ourselves search for it with the closeness that is habitually employed by its natural enemies we have relatively little difficulty in finding the average leaf-laid egg, at least suggests that it is not amongst such eggs but amongst those that are concealed in earth, stems, etc., that we must look for the higher grades of palatability. The inference that it was through repugnance to them that the ants avoided the eggs was confirmed by their repugnance to newly-hatched larvae as compared with older ones.

3. Experiments on Cockroaches, a Cricket and a Coccinellid.

April 28th, 1913.—Early in the day I placed in a small gauze-covered box with two live larval cockroaches thirteen eggs of *Acraea aglaonice*, twelve of *Acraea caldarena*, ten of *Pyrameis cardui* and three of *Papilio dardanus* ♀ f. *hippocoon*. None had been eaten by evening, and during the evening the cockroaches escaped. I replaced them at about 10 p.m. in the evening by two adult and three larval cockroaches of the same species.

I left in another small box with a female of the carnivorous ladybird *Alesia bidentata* a number of eggs of *A. caldarena*, three of *hippocoon* and one of *P. cardui*.

[Cockroaches were of our common Gazaland species.]

April 29th.—No developments in the cockroach box. In the other box the *Alesia*, instead of eating the egg, has

merely added to them one of her own. It is laid beside the *Acraea* eggs on a small bit of green *Wormskioldia longipedunculata* leaf.

April 30th.—Removed the eggs supplied to the *Alesia*, since she continued to refuse them, and placed them in a gauze-covered box with a carnivorous cricket (*Arytropteris* sp.).

May 1st.—No developments in the cockroach and cricket boxes except that the former insects, while still ignoring the eggs, had eaten a portion of a dead companion.

Later.—The cockroaches and cricket persisted in refusing the eggs, not only when unbroken but when damaged by a pin-point. One actual tasting followed by a rejection took place on the part of one of the cockroaches, and eggs extracted from a *hippocoon*'s body were refused. But both cockroaches and cricket ate other food that I eventually offered them, including eggs extracted from small dull-coloured grasshoppers.

Concluding Remarks.—The experiments, were they made on better-chosen enemies, would suggest that openly-laid lepidopterous eggs, generally, are somewhat highly protected by some such quality as nauseousness, though in varying degrees. It was interesting that the egg most frequently taken was a leaf-green one.

As it is, the experiments are open to criticism. Yet they suggest that experiments on visually-discriminating egg-enemies may be well worth carrying out. So far as the parasitic Hymenoptera are concerned, facts have been recorded showing that some, at any rate, of these do *not* recognise eggs visually.

Should further experimentation produce the results that I am inclined to expect, the study of the appearance of insects' eggs is likely to be a very fascinating one. Nor will it be entirely dependent on the obtaining of the food-plant. Thus I have compared the *laid* eggs of quite a number of different species of butterflies with the most advanced eggs still in the bodies of the gravid parents, and I have found that in each case the eggs about to be laid corresponded well in colour and form with newly-laid eggs.

Against this we have the fact that newly-laid eggs—and therefore also eggs extracted from the parent's body—do not necessarily give an accurate idea of what will be the coloration of the egg during the greater part of its existence as such; for many eggs (as those of *Papilio* and

Charaxes) do not attain their full coloration for a day or two after laying, and they darken again when approaching hatching. Yet even here something may be done; for I have found (my observations here being confined, however, to species of the three genera *Pseudacraea*, *Charaxes* and *Papilio*) that a gravid female at death usually contains one fertile unlaid egg, and that this egg, but not the others, goes through its colour-changes within the parent's body (or if extracted from it) just as it would have done after laying, and ends (if the parent's drying be not too rapid) in actually hatching therein. I have taken a live larva, half out of its shell, from the body of a long-dead *Pseudacraea lucretia* var. *expansa*, and it has fed freely when placed on *Chrysophyllum fulvum* (its food-plant in the Chirinda forest) and has quickly proceeded to cover itself in the normal manner with its own frass.

The one fertile egg has of course another obvious application. It may enable us to study the life-history of an insect that has proved refractory about laying. I have bred *Papilio dardanus* from such eggs, and the *Pseudacraea* larva referred to above was already more than a week old and strong and vigorous when it was unluckily accidentally killed. I have, I believe, twice obtained more than one such egg (in each case from a dead *P. dardanus* ♀ f. *hippocoon*) as against more than thirty instances in which there was only one.

[For Mr. Swynnerton's further notes on the eggs of butterflies see Supplement, p. 428.—E. B. P.]

XV. *Some new forms of* Parnassius (Lepidoptera Rhopalocera).

By A. Avinoff, F.E.S.

[Read October 6th, 1915.]

Plates LII–LIV.

In 1914 I wrote an extensive article with descriptions of some new species and forms of the genus *Parnassius* from Northern India and Tibet. I made a comparative study of their relationship with other allied forms, and endeavoured to give a monographical synopsis of the groups in question.

This paper was sent to the Entomological Society of London at the end of July 1914, and crossed Germany on its way to England just at the moment when the war broke out. Now, as the manuscript has thus been lost and I have not reserved a copy, I am obliged to give but short descriptions; and at the present time I am at my duties, far away from my collection. All the necessary bibliography is inaccessible, so that I am compelled to publish merely preliminary notes just to fix the new forms of this interesting genus, postponing their more ample study to some future date. I hope that the photographic illustrations of all the described forms will support the insufficient descriptions, and will guarantee the correct identification.

Parnassius hunnyngtoni, sp. nov. (Plate LII, figs. 1, ♂; 2, 3, ♀.)

I received this wonderful new species through the kindness of Mr. Hunnyngton, in honour of whom I have named this minute *Parnassius*. It comes from high elevations near the Chumbi Valley, South Tibet.

Apparently this new species belongs to the *acco*-group, as may be seen by the corneous bag of the female and the characteristic white scaled veins of the slightly pinkish surface of the underside of the secondaries. Their pattern is very peculiar here, as seen by the figure. Especially conspicuous is the curved band of markings in the wing of the female. In the male this curved band of

markings on the underside is incomplete. It is especially the three patches in the interspaces 2–5 and on that are marked the red scales lacking entirely on this species in both sexes on both surfaces. The inner outline of the basal dark part runs parallel to the inner margin. A dark crescent in the cell seems to be formed by modified black outlines of the obliterated basal and anal red eyelets. The latter row of dark lunulae is similar to these markings of *acco*.

The comparison of the dark basal area of *hunnyngtoni* and *acco* shows the former is very different, as in the latter species this area has an irregular contour near the central cell.

The upperside of the male presents a very strong reduction of dark markings compared with *acco*. There are three dark markings in the discocellular, and merely rudiments of the semi-transparent fuscous bands at the costal margin. The hindwing has no central markings at all, the whole pattern consisting of the submarginal lunulae on the black basal area. The markings in interspaces 5 and 7 are slightly seen on the upper surface, due to the transparency of the wing.

The female has more developed dark markings. The two dark patches of the secondaries corresponding to the usual red eyelets are not large and stripe-like. The markings between them forming an uninterrupted curved band are seen only by transmitted light.

The size of this species hardly reaches that of the smaller *simo* forms. The cilia are very long and of the whitish ground-colour of the wings.

The antennae are yellowish grey, gradually darkening at the extremity. The legs are pinkish. The corneous pouch of the female, being of the general shape and formation of that of *acco*, is comparatively shorter and does not reach so far in surrounding the upper part of the body.

Parnassius acco, Gray, subsp. **hampsoni,** nov. (Plate LII, fig. 4.)

The genuine *acco* is rather a larger butterfly with heavy dark markings and well-developed red ocelli. So are the *acco* caught during my expedition through Central Asia in 1912,* in Eastern Ladak and Rupshu. The Kara-Korum form is smaller, the markings are less heavy, especially the antemarginal lunulae of the secondaries are reduced in

* I have had the honour of making a report of this expedition, on Feb. 5th, 1913, at the meeting of the Entomological Society, *vide* Proceedings, 1913, pp. xi, xii.

size. The ocelli of the secondaries are of a very pale pinkish tinge. This northern form, modified in the opposite direction, as compared with the type from *przevalskyi*, Alph., *baileyi*, South, and *gemmifer*, Fruhst., has full right to receive a special name. I dedicate it to the eminent British entomologist Sir George Hampson.

Parnassius maharaja, sp. nov. (Plate LIV, figs. 1, ♂; 2, ♀.)

The correct position in the genus of this new species is rather doubtful. The pouch of the female shows, however, that it has close affinity with *Parnassius cephalus*, Gr.-Gr., and *szechenyi*, Friv.

The male is white, with a fuscous marginal band and a row of dark submarginal lunulae on the primaries. Between this row and the discocellular is a grey shade at the costal margin. The two black markings of the dark discocellular are well developed. A grey patch in the middle of interspace 1 near the inner margin is indistinct. The secondaries have a dark marginal band and a row of evanescent dark markings. Instead of the ocelli there is a minute dark marking in the interspace 5 and a larger one on the costal margin. In the same interspace 7 there is another dark marking between the ocellus and the basis of the wing—a character typical for *acco, szechenyi, simo* and *charltonius*.

The female has better-developed dark markings, especially on the secondaries, where a complete row of antemarginal markings is present, the two subanal spots being heavier and of a somewhat triangular shape. The discal ocelli are larger, though of a diffuse fuscous colouring, with some pale reddish scales in the upper one.

The cilia of both sexes are black, as in *simo*.

The ground-colouring of the underside of the hindwing, as well as of the apex of the primaries is of the same reddish tinge as in *acco-przevalskyi*. There are no white scales along the veinings as in the latter conspecies. The legs are slightly pinkish. The size of this species is that of large *delphius* forms; the pointed and extended shape of the forewings is very much that of a gigantic *simo*.

Caught on desolate stony slopes near the crest of the Tagalang-la Pass (Rupshu), 18,000 feet, and in the vicinity of Sugetdavan (Chinese Turkestan). I have unmistakably seen a specimen on the Depsang plateau, 17,000 feet, in the Karakoram region, but could not catch the butterfly.

Parnassius acdestis, Gr.-Gr., subsp. **rupshuana,** nov. (Plate LII, fig. 5, ♂; 6, ♀.)

Differs from the type forms especially by the position of the antemarginal markings of the hindwing. These markings are reduced in size, and run further inward at a greater distance from the outer margin. Generally it is only the round black spot in cell 3 that is comparatively conspicuous. It has no blue centre. The next lunule in cell 4 is particularly strongly curved inwardly. The white marginal lunulae of the ground-colouring on the primaries are also removed further from the margin in comparison with *acdestis*. The shape of the primaries is more pointed at the apex, and the secondaries present a slightly pronounced angle in the outline on the outer margin of cell 4.

Locality. Rupshu, Tagalang-la, 17,000–18,000 feet, VII.

Parnassius acdestis, subsp. **ladakensis,** nov. (Plate LII, fig. 7, ♀.)

This is nearest to the typical race from Kuku-nor. The shape of the wings is rounder than in *rupshuana*. The dark markings of the primaries are not so developed as in the latter form. The chief distinctive character of *ladakensis* and *acdestis* is connected with the position of the antemarginal band of markings on the secondaries, which is just as far removed from the edge in *ladakensis* as it is in *rupshuana*. Judging by my single *ladakensis* female from Shera-la (East Ladak), and comparing it with my ten specimens of *rupshuana*, it may be stated that the marking in cell 3 conforms more, by its shape and size, to the corresponding character of the real *acdestis*. The basal greyish area is somewhat lighter.

I have found it useful to publish the figures of two little-known new *acdestis* forms, described lately by Felix Bryk.

Parnassius latonius (Plate LII, fig. 8, ♀), originally described as an independent species, is but a very large and heavily marked form of *acdestis lampidius*, Fruhst., from Sikkim. There is a distinct red basal eyelet on the hindwing. Two specimens of *P. latonius* have been found at Kangma, South Tibet, near Shigatse. One of these specimens I obtained through Bang-Haas in Dresden.

Parnassius acdestis priamus (Plate LII, fig. 9, ♂) has been taken in Central Tian Chan near the Musart Pass.

The comparison of the races presented on Plate LII shows clearly the difference in shape of the wings of the various *acdestis* forms. *Priamus* in this respect rather closely resembles the genuine *acdestis*, though the apex of the primaries is more pointed and sharp. The antemarginal markings are very inconspicuous, but run distinctly almost parallel with and close to the margin as in *acdestis*. Besides the type specimens of Bryk, now in my collection and figured on Plate LII, I have two other examples from the vicinity of Hantengri caught on the Russian border. The male has the ocelli more distinctly joined by a bar as in *latonius*, and the female is characterised by an absolute lack of submarginal markings on the secondaries.

The pouches of the females *acdestis*, *rupshuana ladakensis* and *latonius* are identical, the corneous bag of the Tian Shan race being slightly different in structure.

Parnassius delphius, Ev.

I have to add five new local races to the numerous already known ones of this extremely variable Central-Asiatic species.

Parnassius delphius, subsp. **nicevillei,** nov. (Plate LIII, fig. 1, ♂; 2, ♀.)

One may describe this race from Burzil Pass, Kashmir, as an intermediate link connecting the subspecies *atkinsoni* and *stoliczkanus*, though the affinity with the former is much closer. Its size is somewhat smaller than that of *atkinsoni*. The chief difference consists in the reduction of the dark markings, especially in the discal part of the forewing. On the hindwing the central red ocellus is bright and large, surrounded by a very narrow black ring. The upper ocellus in interspace 7 is reduced in size, rarely red-centred and often almost obsolete. These characters of the formation of ocelli on the hindwing recall subsp. *stoliczkanus*. The submarginal row of blue ocelli is in a darker submarginal zone than in *atkinsoni*, the light interspaces being even narrower or entirely obliterated. I have obtained about seventy specimens of this new race, and might say that the described characters are rather constant. There were two conspicuous aberrations which seem to be very instructive from the phylogenetic viewpoint. One of them has not the usual even row of five

blue ocelli, but the middle one is transformed into a lunule, curved inside in the same way as is the case with the Turkestan forms of the species. Another specimen, having the same character of the submarginal markings of the hindwing, presents other peculiarities connecting it in a striking way to *cardinal*, Gr.-Gr., from Buchara. All the three red ocelli are well developed, surrounded by heavy black rings and joined by black bars. The dark markings of the primaries are also enlarged. This specimen is decidedly larger in size than any other of my *nicevillei*. Not approving the system of giving special names to accidental aberrations, I find it worth while to make an exception for this interesting case of transition between the Indian and Turkestan groups of *P. delphius*, and confer the name of ab. *cardinalina*, nov. (Plate LIII, fig. 3, ♂) to this butterfly, which can be discriminated from the genuine *cardinal* only by the character of the dark margin in the secondaries, and the absence of white scabs in the red ocelli on the underside.

I am glad to be able to publish a figure of a male specimen of *atkinsoni* (Plate LIII, fig. 4), known only by the two original females. My three specimens from Pir-Panjal settle completely the question of the two typical specimens in the British Museum, as they were referred both to Darjeeling and Pir-Panjal. The males agree closely with the description of the females. The red filling of the ocelli is less conspicuous on one of my two males; it is obliterated almost entirely in the upper ocellus, which reminds one very much of subsp. *stenosemus*, Honr.

Lieutenant A. Brownlow, R.A., has had the kindness to transmit to me a fine female of *nicevillei* from Kishtwar Mountains. I have obtained later a male, in very poor condition of preservation, from the vicinity of Zoji-la. Both specimens differ from the typical *nicevillei* by an extreme development of red on the secondaries, and particularly by the thin black encircling of the ocelli. It may be that these characters constitute a true local race.

In the Western Ladak has been found a *delphius* form belonging to the group of *staudingeri*, B. H.—*hunza*, Gr.-Gr. The dark semi-transparent bands of the primaries are shaped as in subsp. *staudingeri*, although they are not so well marked.

The secondaries have two subanal blue-centred ocelli before the margin, the following markings having the

shape of narrow crescents and stripes as in the Turkestan forms. It may be remembered that the two anal markings in *staudingeri* never have blue scales. The general appearance is transparent, more like that of *hunza*. The two discal ocelli of the secondaries are filled with a faint reddish colouring, approaching that of the forms from Central Pamir and Hindukush—*jakobsoni*, Avin., and *hunza*. The main difference of this new Ladak race and *jakobsoni* consists in the characters of the antemarginal markings of the hindwing, the lunule in the interspace 4 being less conspicuously produced inwardly. I call this new race *mamaievi*, from the name of my friend Mr. M. Mamaiff, with whom I made the journey from India to Turkestan (Plate LIII, fig. 5, ♂; 6, ♀).

Near the Saltoro Glacier in Baltistan the expedition of Mrs. F. Bullock-Workman has found a form of *delphius* exhibiting a transition from *mamaievi* to *hunza*. I name it subsp. *workmani* (Plate LIII, fig. 7, ♀). The submarginal markings are distinctly those of *mamaievi*, but very much reduced in size, and transformed into isolated plain dark spots. The upper ocellus of my unique female is black. The discal area of the forewing presents the character of *hunza* in respect of the diffuse dark scaling crossing the wing along the veins in the third interspace.

The Hindukush group of *delphius* races seems to consist as far as known of three races. The two formerly described ones are *hunza* from Beik Pass, and *chitralensis*, Verity, from Chandur. I have these forms in my collection, and notice that the race recently obtained by my friend Mr. A. Smith in the mountains between Kila Drosh and Kafiristan does not belong to either of the two mentioned above. There is no transverse continuous discal band running to the inner margin of the primaries, as is the case in *chitralensis*; on the other hand, the fuscous antemarginal band of the secondaries presents some light interspaces, absent in the true *hunza*. The shape of the hindwing is particularly narrow, with a well-marked angle at vein 6. My two males have heavy anal black markings and dark discal ocelli. The female has merely a few dark scales in the place of the anal patches. The discal ocelli are centred with pale flesh-red.

This new form, which I call subsp. *kafir*, nov. (Plate LIII, fig. 8, ♂; 9, ♀), should be studied with more ample material, which is so hard to obtain from these remote localities.

Subsp. **darvasica**, nov. (Plate LIV, fig. 3, ♀.)

In the mountains of Darvas (Buchara) Mrs. Hohlbeck has recorded a new form closely allied to *illustris*, Gr.-Gr., from the Transalai Mountains (Turkestan). The chief difference from both of them consists in the hyaline transparency of the wings in *darvasica*, not at all connected with the state of preservation; the reddish pigment in the ocelli is exceedingly light in colour. These characters somewhat recall subsp. *hunza*. The submarginal markings present an intermediate character between subsp. *illustris*, with a generally well-developed row of ocelli and lunulae, and subsp. *kirichenkoi*, Avin., with its complete absence of any such markings.

Subsp. **sobolevskyi**, nov. (Plate LIV, fig. 7, ♂; 5, ♀.)

This butterfly has been caught by the young traveller Mr. J. Sobolevsky in the Kiliang Pass in Chinese Turkestan. This form belongs distinctly to the group *delphius-delphius*. It should be ranged closely with *iuldussica*, Verity. The row of usual antemarginal markings of the secondaries is removed far inwardly. Narrow white lunulae divide the markings of the internervural spaces 7–6 from the broad fuscous marginal band. The anal markings are plain black, without blue as in the Tian Shan forms. The discal ocelli are small, the central one with diminished red fillings. The basal grey area is dense, and has the shape of that of the *acdestis* forms (comp. with figures 5–9 of Plate LII). The primaries have no special character compared with *iuldussica intermedia*, Ver., and *delphius* except the apparently constant development of dark scaling all over the surface of the wings.

P. simo, Gray, subsp. **grayi**, nov. (Plate LIV, fig. 6, ♂.)

This is the largest of all the *simo* forms, it stands close to the race *simonius*, Stgr., from which it differs besides the size, by the very heavy submarginal markings of both pairs of wings. The whole dark pattern is well defined on the densely-scaled surface of the wings. This race inhabits the north-western slopes of the Alai Mountains near Jengisbai. My two specimens from this locality are exactly alike. It must be noted that the shape of the wings is just as broad as in the *simonius* race, and has not the acute apex of *simulator*, Stgr., which almost equals

grayi in size. The shape of the antemarginal lunulae of the hindwings is also a good distinct character for discriminating both forms. Those of *simulator* are arrow-shaped, those of *grayi* have not the pointed extremity and present an uninterrupted dark band.

Parnassius charltonius, Gray, subsp. **vaporosus,** Avin.
(Plate LIV, fig. 7, ♂.)

I have described this Darwas form of the glorious North-Indian species from a few females. Now that I have obtained through Mr. A. Hohlbeck a fine series of both sexes, I am able to complete my description, by pointing out the characters of the male. It has very slightly developed submarginal and discal dark bands of the primaries in comparison with the closely allied subsp. *princeps*, Honr. The red-central ocellus of the secondaries presents the same typical character as in the female; it is narrow, elongated in the transverse direction, the inner dark outline forming almost a straight line. The semi-transparent markings near the blue marginal ocelli are somewhat more conspicuous than in *princeps*. This latter character recalls the Indian forms of the species, though *vaporosus* is undoubtedly the lightest form in the whole group of allied local races of *charltonius*.

Parnassius loxias, Püng., subsp. **raskemensis,** nov.
(Plate LII, fig. 10, ♀.)

The typical form of this fine species, originally known only by three specimens obtained by Püngeles from the Central Tian Chan Mountains, has been lately obtained by me from a collector in the same locality in a large series, showing very fully the limits of variation of *P. loxias*. This rich material enables me to recognise and establish with enough certitude a different, though close local race, from the ramifications of the Raskem Mountains, namely, from the Kiliang Pass, where the butterfly has been recorded by Mr. J. Sobolevsky from a single female, now forming part of my collection. It differs from the Northern Tian Shan type in having reduced hyaline margins of both wings, and in a considerable development of the submarginal markings. This part of the pattern of the forewing presents a heavy fuscous band, especially broad in the interspaces 2–4. The discal zigzag band characteristic of the typical *loxias* is absent. The black submarginal

ocelli of the hindwing are enlarged inwardly, and the blue scaling is reduced. On account of the narrowness of the marginal hyaline band the white interspaces between the latter and the ocelli are quite distinct.

The two usual *Parnassius* ocelli are of a very pale slightly orange tint, and scarcely differ in colour from the ground of the whole surface. The basal part of the wing is extremely dark, which is never the case with the true *loxias*.

Parnassius epaphus, Boisd., subsp. **phariensis,** nov.
(Plate LIV, fig. 8, ♂; 9, ♀.)

Close to *P. epaphus* subsp. *sikkimensis*, Elwes, from which it differs by the excessive development of all the dark markings. The red filling of the ocelli on both pairs of wings is very distinct. The red ocelli of the hindwing are usually joined by a dark bar.

This dark form of *epaphas* inhabits Phari-Zong in Southern Thibet.

Explanation of Plates LII—LIV.

[*See Explanation facing the* Plates.]

NEW FORMS OF PARNASSIUS

Explanation of Plate LII.

Fig. 1. *Parnassius hunnyngtoni*, ♂.
2. ,, ,, , ♀.
3. ,, ,, ,, underside.
4. ,, *acco hampsoni*, ♂.
5. ,, *acdestis rupshuana*, ♂.
6. ,, ,, ,, , ♀.
7. ,, ,, *ladakensis*, ♀.
8. ,, ,, *latonius*, ♀.
9. ,, ,, *priamus*, ♂.
10. ,, *loxias raskemensis*, ♀.

Explanation of Plate LIII.

Fig. 1. *Parnassius delphius nicevillei*, ♂.
2. ,, ,, ,, , ♀.
3. ,, ,, ,, , ab. *cardinalina*, ♂.
4. ,, ,, *atkinsoni*, ♂.
5. ,, ,, *mamaievi*, ♂.
6. ,, ,, ,, , ♀.
7. ,, ,, *workmani*, ♀.
8. ,, ,, *kafir*, ♂.
9. ,, ,, ,, , ♀.

NEW FORMS OF PARNASSIUS.

N. Kaminsky, S Petersburg

NEW FORMS OF PARNASSIUS.

Explanation of Plate LIV.

Fig. 1. *Parnassius maharaja*, ♂.
2. ,, ,, , ♀.
3. ,, *delphius darvasica*, ♀.
4. ,, ,, *sobolevskyi*, ♂.
5. ,, ,, ,, , ♀.
6. ,, *simo grayi*, ♂.
7. ,, *charltonius vaporosus*, ♂.
8. ,, *epaphus phariensis*, ♂.
9. ,, ,, ,, , ♀.

XVI. *New* Lepidoptera *from Dutch New Guinea.*

By J. J. Joicey, F.L.S., F.Z.S., F.E.S., A. Noakes, F.E.S., and G. Talbot, F.E.S.

[Read May 5th, 1915.]

Plates LV–LXII.

The forms herein described were all taken by Messrs. A., C., and F. Pratt, and, except where otherwise stated, were collected at the Angi Lakes, Arfak Mountains, 6000 feet, January to March 1914. The types are in the collection of Joicey.

Our thanks are due to Lord Rothschild, Dr. K. Jordan, and G. T. Bethune-Baker, Esq., for kind help and the opportunity of comparing specimens in their collections. We are also indebted to Sir G. F. Hampson for useful help with the Heterocera.

Forty-four forms are described as new in the present paper, and five of these represent the ♀♀ of forms already described from ♂ specimens.

RHOPALOCERA.

(By Joicey and Noakes.)

Papilionidae.

1. **Papilio (Troides) tithonus prominens,** subsp. nov.

(Plate LV, fig. 1, ♂; Plate LVI, fig. 1, ♂.)

We are not sure, in the absence of more material, whether the ♂ described below is associated with the ♀ upon which we base the subspecies.

♀. Cell-spot of forewing rounded, and all spots suffused with dark scaling. Hindwing with a small cell-spot as in *waigeuensis*, Roths. Abdomen with segments mostly black laterally and fringed with black hair ventrally to a greater extent than in other forms of the species.

♂. Forewing above with costa and apex more broadly black and costal patch reduced; in cellule 8 there is only a nebulous streak.

The outer edge of the stripe in 7 is about level with that in 6 giving the costal patch a more wedge-like than oval shape. In cellule 9 are only a few scattered scales. The median patch is produced anteriorly to above vein 5 as a narrow spur.

1 ♂ from Angi Lakes, 1 ♀ from Momi, 4000 feet, February.

2. **Papilio (Troides) tithonus misresiana,** subsp. nov.*

(Plate LVII, fig. 1.)

♀. Forewing with cell-spot smaller than in the type-form, second discal spot larger, apical spots a little larger. Hindwing with cell-spot small as in *waigeuensis*, Roths., marginal black broader especially in cellules 4 and 5.

3 ♀♀ from Mount Misresi, 3000 feet, Arfak Mountains, Jan. 1910, A., C., and F. Pratt. 1 ♀ in the Tring Museum bearing same locality.

3. **Papilio (Troides) paradisea arfakensis,** subsp. nov.

(Plate LVIII, fig. 1, ♂.)

This well-defined local race is particularly interesting as exhibiting in the ♀ a likeness to *meridionalis*, Roths.

♂. *Upperside.*—Forewing with costa more broadly black and golden patch therefore narrower than in the type form. The interspace between veins 9 and 10 is sparsely scaled with green. The costa is thinly scaled with green to about half length of cell. The median patch is distally rounded so that the black margin is wider near the outer angle than it is in the typical form. Hindwing with yellow extending beyond cell in cellules 3 and 4 and to a greater extent in the co-type. The black margin is somewhat broader between veins 5 and 7. The tails are shorter and more blunt.

Underside of forewing with costal black entering cell, extending along its upper margin and joined to a black bar crossing middle discocellular between veins 5 and 6 and projecting beyond cell for a third of its length; this bar cuts off a small green patch at upper angle of cell. The apical black is extended between veins 7 and 8. The inner margin is black except for a small patch of green at the middle. Hindwing as above. Legs entirely black.

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* The ♀ figured by Kenrick, Trans. Ent. Soc., 1911, Pl. IV, is evidently this form, whilst the ♂ on Pl. III is probably also referable to *misresiana*.

The co-type has the forewing markings a greenish-blue, the costal patch being slightly tinged with gold.

♀. Forewing with cell-spot proximally rounded, discal spots well defined. Hindwing with discal band filling outer two-fifths of cell and extending into cellule 6 as in some specimens of *meridionalis*, though to a greater extent. The black spot in cellule 6 is well defined; the spot at inner margin touches vein 2 and is confluent with the black ground-colour. The discal area of the band is white as in *meridionalis*, though more or less clouded with dark scales over a short area proximally of the spots.

The abdomen below has the segments hairy at their apices.

2 ♂♂ and 4 ♀♀ were obtained.

4. **Papilio albertisi,** Oberth. ♀.

Papilio albertisi, Ob., Et. d'Ent., 4, p. 41.

Resembles the ♂ above. Below it is paler, specially the apical band of the forewing and the distal margin of hindwing. The yellowish bordering to the submarginal spots is more developed.

A single specimen. There is also a specimen in the Adams Coll. in the British Museum, which was also obtained by Mr. Pratt in Dutch New Guinea.

PIERIDAE.

5. **Leuciacria acuta,** R. and J. ♀.

(Plate LV, fig. 2.)

♂. *L. acuta*, R. and J., Novit. Zool., 1905, p. 463; Seitz, Macrol., 9, p. 121, pl. 73*a*.

♀. *Upperside* dirty white. Forewing with outer margin, costa, and base brownish-black. Outer marginal border broad and narrowing posteriorly, its edge incurved but projecting in cellule 3 to half length of cellule, rounded in cellule 1*b*. A discocellular spot, brownish-black and oval, joined to the costal black. Hindwing with some black and yellow dusting at base and some black dusting at apex.

Underside darker than in ♂. Forewing with basal half of cell purplish, a discocellular spot as above. A subapical brownish-black band, broadest on costa and reaching vein 4, followed by a spot in 3 and a smaller one in 2. Apex lilac. Hindwing with 3 faint submarginal spots in 3–5.

Two specimens obtained, also a long series of ♂♂.

6. **Delias elongatus,** Kenr. ♀.

(Plate LVI, fig. 2.)

D. elongatus, Kenrick. Trans. Ent. Soc. Lond. 1911, p. 19, pl. iii, fig. 4, ♂.

♀. *Upperside.*—Forewing with spots pale buff. A little whitish scaling in basal half of cell. Hindwing with light area cream-colour, a black spot outside cell and touching it, between veins 4 and 6. Basal half of cell black with a few light scales. Marginal border wider than in ♂.

Underside.—Forewing with triangular patch reduced. Hindwing with discal purple area washed out and spot at end of cell enlarged.

Length of forewing: 31 mm.

3 ♂♂ and 3 ♀♀ of this species were obtained.

7. **Delias pratti,** Kenr. ♀.

D. pratti, Kenrick, Ann. and Mag. Nat. Hist., Ser. 8, vol. 4, 1909, p. 177, pl. vi, fig. 2, ♂.

The ♀ does not differ from the ♂ except in having slightly rounded wings.

Several specimens obtained, also a long series of ♂♂.

8. **Delias castaneus,** Kenr. Pupa.

D. castaneus, Kenr., Ann. and Mag., Ser. 8, vol. 4, 1909, p. 181, pl. vii, fig. 3.

The pupa case here described was found on some sort of mountain grass, to which it is still attached. The insect emerged at 3.30 p.m. on Feb. 17, 1914.

Colour pale brown. Head bearing a forked protuberance, the two curved ends of the fork and the pedicel below black. Two short black tubercles at base of head. A dorsal row of black spines on somites 2–7. Two short black lateral spines on the first abdominal somite, 2 lateral black spines on the second, and 4 on the third somite.

DANAIDAE.

9. **Danaida weiskei thalassina,** subsp. nov.

(Plate LV, fig. 3, ♂, fig. 4, ♀.)

♂. *Upperside.*—Forewing with costal streak obsolete, spot near end of cell with its long axis directed basally, discal spot in cellule 2

smaller than in *weiskei*, patch below cell larger and produced basally and distally with lower edge touching submedian, a streak below submedian shorter than patch above it. The post-discal spot in 2 stands midway between discal spot and margin. Three submarginal dots in cellules 3, 4, and 6. Hindwing with the greenish-white area extended to extreme base and patches round cell enlarged, especially below cell, so that the outer edge of this area is nearly regular.

Underside similar to above. Forewing with costal and streaks beyond cell more distinct. Inner marginal streak extended to near outer angle. Hindwing with reduced light area, post-cellular patches separated and absent in cellules 2 and 3.

♀. *Upperside* of forewing similar to ♂, but markings slightly enlarged. Hindwing with greenish-white area extended far beyond cell leaving a black margin 3 mm. wide which slightly invades the light area on the veins. Some marginal dots from cellules 3 to anal angle.

Underside similar to above. Hindwing with light basal area reduced, the post-cellular patches being invaded by the ground-colour. A series of rounded submarginal spots, one each in cellules 6–4 and a pair in each of cellules 2 and 3; another spot behind vein 2. A series of marginal dots in pairs between the veins, those in cellules 5 and 6 being enlarged longitudinally.

A series of 6 ♂♂ and 2 ♀♀ obtained.

10. **Danaida melusine oetakwensis,** subsp. nov.

♂♀. Forewing with subapical patches larger, especially the spot in cellule 4, but not so large as in *meeki*, Gr.-Sm.; the patches in 5 and 6 converge more proximally than in the typical form. Hindwing with more brown at the base, the costal stripe being much shortened, though in one specimen in the Tring Museum this stripe is not abbreviated. The post-cellular spots are closer together and are larger in cellules 2 and 3 than in the type-form. The spot in 6 is much reduced.

Snow Mountains, near Oetakwa River, up to 3500 feet. 3 ♂♂, 3 ♀♀ Coll. Joicey, also in Coll. Rothschild. Specimens in Tring Museum from Upper Aroa River also seem to agree with this form.

11. **Danaida melusine grosesmithi,** subsp. nov.

(Plate LVI, fig. 3, ♂, fig. 4, ♀.)

Differs from the typical form in reduced markings on both wings.

♂. Forewing: median patches not touching cell and much shorter than in *melusine*. The lower median patch composed of two confluent spots, smaller than the upper patch. Subapical spots reduced, the one in cellule 6 only half the length of spot in 5. Hindwing with reduced costal patch, discal patch reduced distally. Veins of cell brown, being scaled with white in both *melusine* and *meeki*. Spot in cellule 6 absent. Three white submarginal apical spots.

Underside with a small spot at base of cellule 8, well marked in the ♀. This spot is absent in all other forms of *melusine*.

♀. Resembles the ♂ but markings more extended and spots larger. Hindwing with a submarginal row of 5 spots in 2–6.

♂. Mount Misresi, Arfak Mountains, 3000 feet, Jan. 1910, A., C., and F. Pratt. ♀, Angi Lakes, Jan.–Feb. The only specimens of this rather specialised form.

Amathusiidae.

12. **Morphopsis ula brunnifascia,** subsp. nov.
(Plate LX, fig. 1.)

♂. The band on the forewing is much narrower than in *ula*, R. and J., and is yellowish-brown except for a creamy oblong spot on the costa. The band is slightly separated from the submarginal lines, and the part lying in cellule 2 is larger than it is in *ula*. The hindwing is darker, the eyespot has no outer ring and the blue iris is somewhat reduced. On the *underside* the blind ocelli in 3 and 4 are confluent and their dark centres are lunate. In a specimen taken in March the underside is much lighter than in *ula*, and the forewing shows a well-marked creamy band below.

Two specimens were obtained. The collector notes that it flies near the ground.

Satyridae.

13. **Platypthima pedaloidina,** sp. nov.
(Plate LVII, fig. 2, ♂, fig. 3, ♀.)

Near to *decolor*, Jord.

♂. *Upperside* of forewing with a pale discal patch from inner margin into the cell, narrowing anteriorly. Beyond cell a pale stripe from costa to vein 2, where it ends in a point and touches the suffused outer edge of the discal patch. Hindwing with a pale discal band from costa to vein 2, constricted at vein 5 and irregularly defined proximally.

Underside of forewing with inner-marginal yellowish-white area entering the cell between veins 2 and 3. A well-defined lighter-coloured band not touching cell, from costa to vein 2 where it touches the submedian patch. Two very small apical ocelli consisting of an indistinct black pupil with a white iris, in cellules 4 and 5. At the apex some reddish-brown scaling. The submarginal bluish-grey line is more strongly crenulate than in *decolor*. Hindwing with a small triangular white spot in centre of cell. The white discal band is proximally dentate and only extends to the cell, continuing as a zigzag line to middle of 1*c*. A red-brown spot, faintly edged with white proximally, fills end of cell. The base and inner margin more thickly sprinkled with greyish scales than in *decolor*; ocelli all smaller and including one in cellule 5.

♀. Similar to ♂ with more rounded wings and paler markings above; the two anal ocelli on hindwing more distinct. Below, the costal band on hindwing is narrower and the spot in 2 is larger.

Length of forewing: ♂ 20 mm., ♀ 21·5 mm.

A series of ♂♂ and 2 ♀♀.

14. **Harsiësis hygea chalybe,** subsp. nov.

♂. *Upperside* similar to *noctula*, Fruh., but with blackish-brown margins which are wider on hindwing and merge into the blue-grey colour. *Underside* with distal half of forewing paler and no band as in *noctula*. The chain of ocelli on hindwing has a lighter ground-colour and stops at vein 2.

♀. *Upperside* much paler in colour, especially the outer half of hindwing. *Underside* of forewing shows a better defined dark basal area against a paler apical half. Hindwing below scarcely paler than in the ♂.

1 ♂, Angi Lakes; 1 ♂, Coast near Manokwari, Jan.–Feb., 1914.

Coast District, Geelvink Bay, Dutch New Guinea, Nov. 1914, 1 ♂, 2 ♀♀.

15. **Mycalesis barbara fulvo-oculatus,** subsp. nov.

(Plate LVIII, fig. 2.)

♂. Wings more rounded than in typical form. *Upperside.*—Forewing with narrower band especially in cellules 2 and 3, median ocellus faintly ringed with yellowish. Hindwing with band widened distally and extending almost to first submedian; some yellowish scaling on inner margin. The two anal ocelli well developed and

ringed with fulvous. The general ground-colour paler than in typical *barbara* and bands also paler.

Underside of forewing with marginal line almost straight, and outer marginal area lighter. Hindwing with proximal edge of white band irregular.

Length of forewing: 26 mm.; *M. barbara*, 24 mm.

1 ♂. Coast near Manokwari, Jan.–Feb. 1914.

16. **Mycalesis nerida angiana,** subsp. nov.

(Plate LVIII, fig. 3.)

♀. *Upperside.*—Forewing with the outer edge of the darker basal area very slightly incurved and straight in the lower median space. Submarginal line thinner and space between it and marginal line a little wider than in *elia*. Costal and apical black reduced. On hindwing the marginal and submarginal lines more strongly undulate.

Only one specimen was obtained.

17. **Mycalesis lorna fumosus,** subsp. nov.

(Plate LVII, fig. 4.)

♂. *Upperside* much darker than *lorna*, Sm., blackish-brown, rings of ocelli indistinct.

Underside deep purplish-brown, the lighter distal part widened proximally of the ocelli.

Only one specimen obtained.

Erycinidae.

18. **Abisara tessei,** sp. nov.

(Plate LVIII, fig. 4, ♂.)

♂. *Upperside* similar in appearance to *weiskei*, Roths. Forewing crossed at its centre by a light-brown band about 2 mm. wide which consists of a short costal band reaching vein 4, touching it and the veins a square spot in 3 placed distally, and a narrow spot in 2 between veins 2 and 3 and reaching to within 2 mm. of margin. Base dark chestnut-brown, filling the cell to vein 3, and base of cellule 2 and half of 1, extending along lower submedian to almost the outer angle. A well-defined subapical white spot in 6, and traces of white dots in 7 and 8. Hindwing chestnut-brown, costal area broadly black and distally almost touching vein 4. A white patch of scales at base of costa. Three black submarginal spots, the

largest in 3, the first indistinct in 1*c*. Black marginal spots on veins 2, 3, and 4, the first the largest.

Underside of forewing of burnt umber ground-colour with the band white tinged by the brown showing through from above. A white post-discal line narrowing posteriorly, from near apex straight to vein 3 and continued to 2 by a thin brown line which borders the outer edge of the end spot of the discal band. A white bar crosses the cell between veins 2 and 3. The inner marginal area, extreme base of cell, basal part of 2, and extreme base of 3, paler than rest of wing. Hindwing pale umber with costa, subapical area, and discal spots of same colour as forewing. A spot in cell joined to one across upper end of cell, a double spot beyond cell in 4 and 5, a smaller placed more distal in 3, one below it in 2, one more proximal in 1*c*, and one adjoining in 1*b*, a white spot on costa near base. Submarginal black spots in 1*c*, 2, 3, 4 and 5, those in 2 and 3 being the smaller, in 4 and 5 joined to form an oblong spot; all proximally bordered with white, and outwardly edged with white except the spot in 5. A white spot at anal angle in 1*b* joined by a pale streak to the anal spot. The spots in 1*b* and *c*, 2 and 3, have proximally an ill-defined triangular dark spot. The margin is edged with rufous from the anal angle to vein 6, interrupted on 2, 3, and 4 by a black spot.

Antennae black, tipped with yellowish-brown. Head, thorax, and abdomen pale brown above, white below; frons edged laterally with white. Palpi yellow. Legs brown on outside, yellowish-white inside.

♀. Larger, wings more rounded, similar to ♂ in appearance. Forewing with a wider discal band. An apical band of 5 small white spots from costa to cellule 4. Hindwing as in ♂, but with an ill-defined black discal spot in 3.

Underside with basal area of forewing paler than in ♂ and extending to near end of cell, leaving a rounded spot of ground-colour at origin of vein 2. Hindwing with paler ground-colour and spots. The spot in cell and one beyond it are much smaller and with the costal spots stand more free in the ground-colour than in ♂. The discal spots in 2 and 3 are enlarged. The forelegs have the tibia and tarsus yellow-brown.

Length of forewing: ♂ 29 mm., ♀ 32 mm.

A series of both sexes.

19. **Dicallaneura amabilis angustifascia,** subsp. nov.

(Plate LIX, fig. 3, ♂, fig. 4, ♀.)

♂. *Upperside* of forewing with a narrower and darker band than in *amabilis*; hindwing tinged with chestnut-brown.

Underside of forewing similar to upper; hindwing much deeper in colour than in *amabilis* and with no admixture of greyish.

♀. *Upperside* of forewing with band much reduced proximally. Base to beyond end of cell grey-brown shading into fulvous bordering the band, and also in the lower median interspace along inner margin to end of submedian. The yellow part of band is limited posteriorly by vein 2. Hindwing differs from *amabilis* in being fulvous and only a little darker at the base; marginal spot in cellule 4 absent.

Underside of forewing with band as above; the dividing stripe is twice as thick as in *amabilis* ♀; costal stripe near apex broader. Hindwing paler than in ♂.

A single pair only obtained.

20. **Dicallaneura fulvofasciata,** sp. nov.

(Plate LX, fig. 2, ♂; Plate LIX, fig. 5, ♀.)

The ♀, which we place here provisionally, shows close relationship to *leucomelas*, Roths.; but the ♂ should be similar. It is still doubtful, therefore, whether the sexes described below are one and the same species.

♂ recalls the *amabilis* form. *Upperside* of forewing with basal part to end of cell and inner marginal area to outer angle dark vandyke-brown, the costa lighter. Adjacent to this a yellowish-brown band 6 mm. broad from costa to submedian fold, where it is 8 mm. broad; rest of wing black. Hindwing vandyke-brown, veins streaked with yellowish-brown beyond cell. A marginal black spot in 5, one in 4 edged outwardly with yellowish-brown, a larger in 3, the tail black fringed with white.

Underside of forewing chestnut-brown. A white discal band from costa to inner margin, widening posteriorly from vein 4 and traversed by a yellowish line from 4 to lower submedian and angled at 2. Across the cell are 2 curved grey streaks. A short white streak at costa just beyond band, and another nearer the apex. A thin curved bluish streak from vein 6 to 3. A submarginal line paler than ground-colour and nearly parallel to margin. A bluish apical dot in 6 and one in 7. Hindwing ground-colour as forewing, but much covered with short grey hair leaving marks as follow:— Two stripes in cell, a band beyond cell from costa to vein 4, a discal band from lower submedian to 2 and continuing to costa in increasingly large spots, the last three marked each with a bluish streak. A marginal spot in 4 with a white streak, a submarginal and a marginal spot in 3, each streaked with white, a submarginal spot

in 2 continued as a streak to submedian, two white anal streaks. Tail with a black spot edged with white distally. A black marginal spot bearing a white dot, in 5.

♀ resembles *leucomelas* ♀. *Upperside* of forewing with a brown dot on the discocellular. Hindwing for the greater part white to vein 3 near margin, and to 2 halfway from cell. The remainder, including cell, smoky-brown.

Underside much as in *leucomelas*. Hindwing with larger white costal patch and from which the spot in 5 is absent; marginal border little paler than the ground-colour.

Head, thorax and abdomen vandyke-brown above, in the ♂ pale yellow below, white in the ♀. Palpi white, deeper yellow laterally. Legs black on outside, pale yellow inside. Antennae black, slightly tipped brown.

Length of forewing: ♂ 24·5 mm., ♀ 23·5 mm.

A series of both sexes.

21. **Dicallaneura exiguus,** sp. nov.
(Plate LX, fig. 3, ♂, fig. 4, ♀.)

A smaller form than *fulvofasciata*, but closely allied to it. The ♀ shows a trace of a brown stripe in the white band below and in this it differs from *leucomelas* ♀♀.

♂. *Upperside* of forewing with a shorter band than in *fulvofasciata* and not reaching costa; part beyond cell narrower, but at vein 2 is 8 mm. wide. Proximal edge of band merged into the basal brown. Hindwing a little paler than in *fulvofasciata*, with a brownish costal suffusion.

Underside with markings lighter and better defined than in the allied form; the brown line within the band is straight and terminates on vein 2. The submarginal line is creamy-white and the costal streak next it is continued as a zigzag line from vein 5 to 4, where it joins the submarginal and encloses a space mostly filled with creamy-white. Hindwing markings much as in the allied form. There is a small greyish-white triangular costal patch at beginning of discal band, and the grey hair does not fill the basal half of cellules 1, 2, 3.

♀. *Upperside* of forewing similar to *fulvofasciata* ♀. Hindwing with white area reduced and terminating on vein 4; veins 2 and 3 streaked with greyish-white, and two bands of same colour before the margin across interspace 3.

Underside similar to ♂. A faint brown streak in the white band. On the hindwing the costal patch is enlarged and is white.

Head, thorax, abdomen, legs and palpi as in *fulvofasciata*. Antennae wholly black.

Length of forewing: ♂ 19 mm., ♀ 19 mm.

3 ♂♂, 6 ♀♀ obtained.

Lycaenidae.

22. **Cyaniris manokwariensis**, sp. nov.

(Plate LX, fig. 6.)

♂. *Upperside* bright blue. Forewing with a well-defined outer black marginal border; fringe black except at tornus, where it is white; costa very narrowly black. Hindwing with costa smoky-black, a faint whitish scaling in cellule 6, fringe white.

Underside grey-white with dull black markings. Forewing with a line closing the cell, a submarginal row of linear spots, a marginal row of dots. Hindwing with 4 subbasal spots, one in the cell the larger; a line closing the cell; beyond the cell a linear spot in 7, one below it shifted in, 2 others similarly placed but nearer the margin in 4 and 5, a dot at base of 3, a small spot near base of 2 and below it in 1*c* a curved mark, a small spot in 1*b* on inner margin, a marginal series of dots.

Near *C. drucei*, B.-Baker. Length of forewing: 13 mm.

A series from Angi Lakes and coast near Manokwari.

Hesperidae.

23. **Telicota fulvomargo**, sp. nov.

(Plate LX, fig. 7, ♂.)

♂♀. *Upperside* deep olivaceous-brown with an inner marginal yellowish-brown stripe on forewing extending from base to near the termen where it is produced just above submedian. The stigma on forewing of ♂ extends from base of vein 4 to the submedian just proximally of the upper part of the brown patch.

Underside of forewing deep olivaceous brown. A subapical streak of 3 contiguous pale yellowish spots, 2 larger submarginal yellowish spots joined in 4 and 5, a marginal row of 7 white dots. Hindwing with basal two-thirds white and pale yellow leaving a marginal band of ground-colour 5 mm. broad. The basal area is pale yellow on costa, at inner and along outer margin, and in cellule 4 where it projects more than halfway into the marginal area. A spot of the marginal ground-colour at end of cell and lying mostly outside it, another in 1*c* and touching vein 2, and a small spot at base of 2. A marginal series of 6 yellowish dots.

Head, thorax, and abdomen dark olivaceous-brown above, below

pale yellow except abdomen which is only so at base. Palpi yellowish white, black at sides. Legs with tarsus and tibia of general ground-colour, rest yellowish. Antennae black, base of club yellow beneath.

Length of forewing: 19 mm.

Only 3 ♂♂ taken.

HETEROCERA.

(By Joicey and Talbot.)

Arctiadae.

24. **Diacrisia holobrunnea,** sp. nov.

(Plate LXI, fig. 4.)

♀. Fuscous-brown dotted over with black scaling. *Upperside.* Forewing with discocellulars black. Beyond the cell a faint curved discal line from costa to inner margin, emphasised by black dots on veins 2–5. A second faint curved line about 2 mm. beyond, darker on costa and ending just perceptibly on vein 2. A submarginal row of dots on the veins. Hindwing paler; cell closed by a well-marked discocellular spot; some submarginal spots which are faint at the apex and well-marked posteriorly.

Underside paler than above. Forewing with a black spot on costa near base, a thin streak on costa at end of cell, a large black subapical costal spot, a small apical spot and two below it. An ill-defined narrow oblique band almost joined to the subcostal spot and ending faintly on vein 2. Hindwing with a streak in the cell, a discocellular spot, a costal streak above it, and submarginal spots better defined than above.

Head, thorax, and legs fuscous-brown. Fore femora reddish at base on inside. Abdomen yellowish above, fuscous below; a black dorsal stripe and two lateral rows of black spots on ventral segments.

Length of forewing: 28·5 mm.

A single example.

25. **Diacrisia rubribasis,** sp. nov.

(Plate LXI, fig. 1.)

Allied to *pratti*, B.-Baker,* but distinguished at once by the absence of the broad dark stripe on thorax and by having a dorsal stripe on abdomen instead of a row of spots.

* *Diacrisia pratti*, B.-Baker, Nov. Zool., xi, 1904, p. 412.

Upperside. Forewing buff; 4 black costal spots, one at base, one opposite vein 2, one beyond end of cell, and one before apex; antemedial line dark orange and indistinct, angled outwards at vein 2, where it joins a similarly coloured line connected with an indistinct discocellular spot of dark orange; postmedial dark orange line from the third costal spot, curved outwards to vein 5 and then oblique and terminating on inner margin in 2 black spots which vary in size; a submarginal row of black dots. Hindwing pale orange-yellow to reddish; a large black discocellular spot; a submarginal row of 6 to 9 black spots, the two at anal angle nearer the margin, the spot in cellule 3 the smallest.

Underside. Forewing buff, cell washed with red; a small discocellular spot which is typically a dot at upper angle; costal spots as above, the fourth forming a bar which is narrowly separated from a broad black postmedian stripe continued to 1*b*; 2 spots on inner margin as above and a series of submarginal dots. Hindwing with spots as on upperside.

Head and thorax buff; mesothorax with a black median line; antennae brown, shaft black; pectus and legs sooty black; abdomen orange-yellow to reddish, paler beneath, a black dorsal stripe, lateral row of black spots.

Length of forewing: 23–25 mm.

7 ♂♂ from Angi Lakes.

26. **Diacrisia ruficosta,** sp. nov.
(Plate LXI, fig. 2.)

Allied to *meeki*, Roths.*

♂. *Upperside.* General colour pale buff. Forewing with a spot on costa near base, a small spot in cell near upper angle, two pairs of spots near apex, an oblique row of 6 small spots from apex to below vein 6, a dot each on veins 3–5, a pair of dots on submedian at a third from base, a pair of spots, the lower the larger, at two-thirds from base, a pair of dots at end of submedian. A faint orange line follows the cell from its upper angle to vein 2 and runs to the first pair of inner marginal spots. A better-defined orange line joins the first pair of spots near apex to the second inner marginal pair; it curves outwardly to vein 4, then inwardly, and bears faint pairs of dots on veins 3, 4 and 6. Hindwing with a square spot on upper discocellulars, a submarginal spot in 5 divided by the veins, a dot in 2, a spot in 1*c*, a rounded anal spot.

Underside pale buff. Costa of both wings orange. Basal area of forewing and inner margin of hindwing washed with orange.

* *Diacrisia meeki*, Roths., Nov. Zool., xvii, 1910, p. 144.

Forewing with a black spot closing the cell, a spot on costa near base, a dot below origin of 7, two spots in cellules 6 and 7, small apical spots as on upperside and continued as a row of oblong spots from above 5 to below vein 2, only separated by the veins, two spots on inner margin, a faint spot at tornus. Hindwing as on upperside, and with a small spot in middle of cell.

Head and thorax buff, the latter with a black mesial line and greyish below. Palpi, side of frons, fore coxae on inner side, mid and fore tarsi and tibiae, and hind tarsi black. Mid and fore femora and fore coxae on outside orange. Hind tibiae and femora pale greyish-buff. Abdomen golden-orange above, below as thorax.

Length of forewing: 26 mm.

Two specimens obtained.

27. **Diacrisia biagi angiana,** subsp. nov.
(Plate LXI, fig. 3.)

♂. Paler than *biagi*, B.-B.,* and with reduced spots. Forewing with spots in cell and on veins 2–5 much reduced, and the pair of small spots below cell at base are absent. A large costal spot before middle of cell, another at end of cell. Spots on hindwing reduced, and especially the one at end of cell.

A series of 11 specimens.

A specimen in the Mus. Brit. from Ninay Valley, Arfak Mountains, is intermediate. The forewing has vestigial costal spots and reduced apical spots.

28. **Diacrisia hampsoni,** sp. nov.
(Plate LXI, fig. 5.)

♂. Ground-colour pale buff. *Upperside* of forewing with large velvety black patches. Three on the costa all reaching to below the cell and the outer to beyond end of cell; the first two at base are merged together, the third is much larger and is slightly separate. A square-shaped patch before the apex, a smaller one at the apex, a triangular one below it on the outer margin, an oblong marginal spot near tornus, a discal patch in cellule 2. On the inner margin are 4 rounded patches, one subterminal and separate, the others merged together. A spot at extreme base of costa and an orange spot below it. Hindwing with basal and inner-marginal area washed with yellow ochreous. A rounded black marginal spot on first submedian.

Underside of forewing as above, spots not velvety and all separate. Some orange-coloured hair at the base, and inner margin faintly yellowish. Hindwing orange at base, anal spot as above.

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* *D. biagi*, B.-B., Nov. Zool., xv, 1908, p. 190.

Antennae ciliate. Head, palpi, and thorax velvety black. Crown of head, tegulae, and patagia fringed with orange-yellow. Pectus orange. Abdomen yellow-ochreous, more orange below, terminal segment black above. Tarsi and tibiae smoky-black, femora on the outside smoky-black, on inside orange.

Length of forewing: 22 mm.

This is one of the most distinct species of the genus, and belongs to the last section as defined by Hampson, of this somewhat extended genus. Five specimens were obtained.

NOCTUIDAE.

Subfamily *HADENINAE*.

29. **Dasygaster stigma,** sp. nov.

(Plate LXI, fig. 6.)

This species is nearest *reversa*, Moore, on account of its ciliate antennae, excised termen of hindwing, and elongate claspers.

♂ ♀. *Upperside.* Forewing pale chocolate-brown; subbasal line indistinct; antemedial line waved and defined on outer edge by darker brown; claviform and orbicular moderate in size, reniform larger, all defined by darker brown; a dark streak through cell from orbicular, interrupted by reniform, heavily marked from here to postmedial line and continued indistinctly to margin; an indistinct oblique median line from angle of vein 4 to inner margin; postmedial line crenulate and edged distally with pale brown, excurved to vein 4 and then oblique to inner margin; subterminal line indistinct, farthest from margin between veins 5 and 6; a marginal series of lunate black marks between the veins; fringe lighter brown at the veins. Hindwing smoky-brown, lighter at base, outer margin finely edged with black, fringe proximally pale brown on outer margin, dirty-white distally and on inner margin.

Underside. Forewing smoky-black, costa, apex, and outer margin rufous-brown, inner margin greyish; postmedial line distinct, straight, black. Hindwing greyish-buff, costal and apical area rufous-brown, a small black discocellular spot, a curved black postmedial line; outer margin below vein 6 broadly smoky-black.

Head, thorax, and abdomen below brown as the wings; tegulae pale at apices, patagia pale near base; abdomen grey above, anal tuft pale buff; pectus dirty white tinged with purplish-brown; tarsi with segments 2–5 black mixed with brown, apices buff.

Length of forewing: 18–20 mm.

3 ♂♂, 1 ♀ from Angi Lakes.

Subfamily *ACRONYCTINAE.*

30. **Trachea brunneicosta,** sp. nov.

(Plate LXI, fig. 7.)

♂ ♀. *Upperside.* Forewing with costa and post-medial band pale rufous-brown; subbasal line marked by a dark dot on costa, a greenish spot on median, and a dark streak below submedian; antemedial line double, oblique, incurved in the cell, filled in with green below 1*b*, and bordered proximally by a greyish-lilac band twice its width; orbicular and reniform of moderate size, green with some brown scaling in centre; postmedial line double, waved, excurved beyond cell, then oblique to inner margin, bordered distally by a greyish-lilac band twice its width; subterminal line dentate, more or less edged with black proximally in cellules 5 and 6; marginal band sap-green and traversed only by a darker band; margin finely edged with black; fringe proximally greenish-yellow, distally smoky-brown; median and basal area below cell and vein 2 green, darker distally of the antemedial line; cell traversed by a black longitudinal streak, which is most heavily marked between end of cell and postmedial line. Hindwing smoky-grey; an indistinct discocellular spot and curved postmedial line; fringe yellowish proximally, dirty-white outwardly.

Underside. Forewing buff; costa and cell from base to a little beyond smoky-black; subterminal line faintly indicated; inner margin towards base clothed with scales giving a metallic greenish reflection in a side-light. Hindwing buff; a well-marked discocellular spot and curved irregular postmedial line; costa narrowly blackish; outer narrow marginal border paler than ground-colour.

Head and thorax reddish-brown mixed with green; abdomen smoky-grey above, paler laterally, tawny beneath; legs reddish-brown, tarsi black and apices of segments buff.

Length of forewing: 19 mm.

1 ♂, 1 ♀.

Clavipalpa, gen. nov.

(Plate LXI, fig. 8*a*.)

Proboscis fully developed; palpi with second segment reaching to about middle of frons, third segment long, naked, porrect, extremity clavate; frons rounded; eyes large, rounded; antennae of ♂ with fascicles of cilia; thorax clothed with hair; pectus clothed with hair; femora fringed with hair; abdomen with dorsal crests on basal segments, and lateral tufts; forewing narrow with a somewhat produced apex, margin crenulate; neuration as in allied genera.

This genus is apparently near to *Data*, Wlk. Type: *C. monogramma.*

31. **Clavipalpa monogramma,** sp. nov.

(Plate LXI, fig. 8, ♂.)

♂♀. *Upperside.* Forewing with deep reddish-brown ground-colour; subbasal line indistinct, marked with grey at costa; antemedial line in triplicate consisting of a pale purplish inner border, a central reddish-brown line, and an outer thin yellow edge, bent outwards at right angles to costa as far as 1*b* and then bent inwards at right angles to its upper part; orbicular moderate, paler than ground-colour, slightly defined by a thin yellowish edge; reniform indicated by a broad bar across end of cell, defined on inner and outer edges by yellowish and with a purplish streak down its centre; postmedial line in triplicate with an outer pale purplish margin, a central line of ground-colour, and an inner thin yellow line, nearly parallel to outer margin, being more oblique below vein 4; a marginal series of purplish streaks on the veins; fringe smoky-brown; a dark green suffusion in bases of cellules 1*b* and 1*c*; distally of postmedial line veins 1*b*, 3 and 4 defined by lighter red-brown and each traversing a small green triangle next the line; a submarginal series of small yellowish triangular spots which is but slightly indicated in the ♀ type; veins proximally of postmedial line more or less defined by pale purplish. Hindwing pale rufous.

Underside pale rufus. Forewing with cell and postmedial line smoky-grey. Hindwing with a large deep brown discocellular spot and a well-marked curved postmedial line.

Head and thorax dark red-brown mixed with grey, legs and abdomen rufous, thorax rufus below.

Length of forewing: 18 mm.

1 ♂, 2 ♀♀ from Angi Lakes.

Subfamily *CATOCALINAE.*

32. **Ulotrichopus longipalpus,** sp. nov.

(Plate LXI, fig. 9, ♀.)

Allied to *dinava*, B.-B.*

♂♀. *Upperside* of forewing dark purplish-brown mottled with lilac. An interrupted dark line at the base. A dark zigzag line forming a large spot on costa, crosses the cell about midway and ends on the inner margin. A round white spot ringed with black near base of cellule 2, a smaller lilac spot in lower angle of cell faintly connected with one in the upper angle to form the outer edge of a large but

* *Ulotrichopus dinava*, B.-B., Nov. Zool., xiii, 1906, p. 246.

indistinct reniform spot. Beyond the cell a white band, well-defined on the costa but for the most part scaled with brownish, curving outwardly and ending indistinctly on inner margin, being interrupted at vein 2 by the ground-colour. A well-marked dark-brown dentate line edged with white distally runs partly in the white band from the costa and then obliquely to inner margin. The median area between the two lines is scaled with greenish. A submarginal crenulate lilac line from vein 10 to inner margin and bordered distally by some dark and indistinct triangular spots which almost touch the dark inner edges of a marginal row of white dots. Hindwing with a black margin about 6 mm. wide and narrowing to the anal angle. Rest of wing pale yellow, inner margin orange-yellow.

Underside of forewing with a smoky-brown ground-colour, paler at the apex, at base yellowish-white. A cream-coloured square spot at end of cell, a small spot at base of cellule 2, a cream-coloured post-discal band from costa to below vein 2, curved outwardly. Hindwing paler than above.

Head and palpi greyish-brown; second joint of palpus with a dark lateral line, first joint longer than in other species of the genus, measuring 2 mm. Thorax chocolate-brown mixed with grey, and below grey-black. Abdomen orange-yellow above, smoky-brown below, anal tuft black. Legs grey-black.

Length of forewing: 30 mm.

♂♀. The description is made from the ♀, as the ♂ specimen is too worn.

Lymantriadae.

Before recording descriptions of the two forms which follow, a preliminary note will be necessary regarding two genera described by Mr. Bethune-Baker in Nov. Zool., vol. xi, 1904.

Pseudodreata, type *strigata*, B.-B. (♂), p. 371.
Cycethra, type *aroa*, B.-B. (♀), p. 393.

The distinguishing characters given of these genera as exemplified in their types do not differ from the structure found in *Colussa*, Wlk. The ♀♀ of this genus are all remarkable for the absence of a frenulum, though it is present in the ♂♂.

The ♀ of the form of *strigata* described hereafter, agrees in its structure with the ♀ of a form corresponding to the ♀ of *Cycethra aroa*.

In view of these determinations we believe it is necessary to sink both genera under *Colussa*, Wlk. This genus

seems to agree best in structure with the *Lymantriadae*, and in which family it is placed in the British Museum.

33. **Colussa strigata inconstans,** subsp. nov.
(Plate LXII, fig. 2, ♂, fig. 3, ♀.)

♂. Very similar to *strigata*, B.-B.,* but differs especially in the absence of all costal black from hindwings. *Upperside.* The two cell-spots on forewing are paler than the ground-colour and thinly ringed with black. The post-discal stripe on both wings is not so heavily marked, and the scalloped line next it on both wings is emphasised by black dots on the veins. The pale area proximally of the submarginal line on both wings is suffused with lavender-grey scaling spread thinly over the yellowish ground-colour. Hindwing with costal area pale yellow to vein 5.

Underside pale yellowish sprinkled with black. The second submarginal line on hindwing only indicated by vein dots.

♀. Pale yellowish-brown, thinly scaled. *Upperside.* Forewing dotted over with purplish scales. An indistinct purplish sub-basal line, a second discal line irregularly curved and crossing cell at vein 3. Beyond cell but nearer to it than to margin, a well-defined deep purplish line slightly convex to vein 2 and then straight to the margin. Parallel to this line a row of dark dots on the veins. A narrow marginal border darker than the ground-colour. A dark spot in middle of cell, a larger round one on discocellulars. Hindwing with a discocellular spot at upper angle of cell. A faint curved discal line crossing cell at vein 3; a post-discal heavily marked dark purplish line, becoming ill-defined towards costa; a row of dark vein dots placed nearly half-way to margin and narrowly separated from a marginal border of purplish scaling.

Underside with post-discal lines and vein dots showing through, discocellular spots with a dark ring.

Head, thorax, and abdomen yellowish-brown, antennae and legs dark brown.

Length of forewing: 37 mm.

2 ♂♂ and 1 ♀ obtained. The ♂ co-type is a much darker specimen.

34. **Colussa aroa angiana,** subsp. nov.
(Plate LXII, fig. 4.)

♀. Differs especially from *aroa*, B.-B.,† in the two transverse lines on hindwing being closer together. General colour pale rufous but the co-type is much redder. Costa and base paler than rest of

* *Pseudodreata strigata*, B.-B., Nov. Zool., xi, 1904, p. 371.

† *Cycethra aroa*, B.-B., Nov. Zool., vol. xi, 1904, p. 393.

wing. Forewing with a faint dark sub-basal line, more distinct on costa, crossing cell just below vein 2 and in line with this vein, then vertically to inner margin. A second line parallel to it, crossing cell below vein 3. An oval black discocellular spot. Beyond cell an oblique dirty-white line at a ¼ from the margin, edged with black distally. A little beyond is a curved row of black vein dots which form the inner border of a pale submarginal band. Hindwing paler costally. A black spot in middle of cell and one at end at upper angle. Post-discal line nearer cell than it is on forewing.

Two specimens obtained.

35. **Euproctis pratti albonotata,** subsp. nov.
(Plate LXI, fig. 10.)

♂. Differs from pratti, B.-B.,* in the purer white of the submarginal and apical spots on forewing, and the more elongate apical spots, the one on vein 7 being longest. The pointed distal ends of the spots touch the margin. The round spot at end of cell is snow-white, smaller than in the type form, and unlike that it does not extend into cell below vein 3. The veins are more strongly outlined with whitish scaling. Hindwing paler than in *pratti* and the veins whitish at their ends.

Underside paler than in the allied form and white spots well marked. Hindwing with veins whitish.

Length of forewing: 22 mm.

4 ♂♂ were obtained.

36. **Euproctis seminigra,** sp. nov.
(Plate LXI, fig. 11, ♂.)

♂. *Upperside.* Forewing with grey-white ground-colour. Base black with a convex outer edge. A dark post-discal band from costa to inner margin and not entering cell, proximally and posteriorly diffuse, and in cellules 3 and 4 joined to a darker marginal border. All veins grey-white. Hindwing smoky black; fringe white from anal angle to vein 4.

Underside. Forewing with base and a large apical area smoky-brown, traversed by the white veins; remainder grey-white washed proximally with pale yellow. Hindwing as above, veins whitish.

Head, antennae, thorax, pectus, and legs smoky-brown. Patagia fringed with yellowish hair. Abdomen black, anal segment fringed with grey-white hair, anal tuft smoky-brown.

♀ like the ♂, but with post-discal band on forewing better defined.

Length of forewing: ♂ 24 mm., ♀ 31 mm.

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* *Euproctis pratti*, B.-B., Nov. Zool., xi, 1904, p. 400.

37. **Dasychira angiana,** sp. nov.
(Plate LXII, fig. 1.)

♂. *Upperside.* Forewing with basal area to end of cell greyish-white and limited by the fourth of 7 black transverse lines. The first of these is sub-basal; the second crosses cell a little below vein 2; the third near second and almost touching where it crosses cell at vein 2, diverging towards costa and inner margin; the fourth, heavily marked and diffuse posteriorly where it joins third line, crosses end of cell and forms a heavy black costal spot connected with a rounded black discocellular spot which bears a grey lunule; fifth line well-marked and waved, the space between it and preceding line filled in with smoky-brown suffusion, distal edge margined with brown and remaining outer part of wing buff. Sixth line thin, extending to vein 3, and marked by a large spot on costa; submarginal line irregularly dentate. Hindwing yellowish-brown with a faint discocellular spot.

Underside yellowish brown, a black discocellular spot on each wing.

Head, thorax, and pectus grey-white, abdomen yellowish-brown. Sides of palpi and pectus anteriorly smoky-black. Antennae red-brown, shaft grey-white. Legs grey-white.

Length of forewing: 30 mm.

A single specimen only obtained.

38. **Lymantria flavoneura,** sp. nov.
(Plate LXI, fig. 12, ♂, fig. 13, ♀.

♂. *Upperside.* Forewing with white ground-colour traversed by waved smoky-black lines as follow:—Three at the base formed of disconnected spots, the outer line crossing cell just below vein 2; fourth and fifth lines more heavily marked, the latter lying outside cell and space between it and fourth filled in with smoky-black from costa to vein 2; sixth line heavily marked, interrupted in cellule 5 by ground-colour and continued from vein 2 to tornus as a heavy black bar; space between lines 5 and 6 filled in with paler smoky-black from costa to vein 2. A seventh submarginal line which is broad and straight from costa to vein 6, then thinner and waved to vein 2 by which it is separated from the bar at the tornus. A marginal row of 8 oblong spots between the veins. Lines emphasised on costa which thus bears 6 spots. Costal edge and all veins yellow. Hindwing pale buff, veins darker, a small blackish anal spot.

Underside pale buff. Forewing with costa edged with yellow and bearing a dark spot at base and another at middle. A black

discocellular spot lying within the cell. Three small marginal spots in 2, 4 and 7. Hindwing with a black discocellular spot.

Head and thorax yellowish-white above. Antennae brownish-black. Tegulae with a smoky spot at apex, patagia fringed with smoky-black. Abdomen pale buff. Pectus scarlet. Femora scarlet, fore and mid femora fringed with white hair on inner side. Fore tibiae fringed with smoky hair on outside and white hair on inner side, mid and hind tibiae fringed with white hair on inner side.

♀. *Upperside.* Forewing pale yellowish. Transverse waved black lines as in ♂. Second basal line absent, line 4 comparatively less heavily-marked below vein 2 than in ♂. Veins slightly paler than ground-colour. Hindwing a little paler with a dark anal marginal spot.

Underside paler than above. Hindwing with a black discocellular spot.

Thorax and abdomen pale yellowish, antennae black.

Length of forewing: ♂ 25 mm., ♀ 38·5 mm.

A series of 16 ♂ ♂ and 1 ♀.

Eupterotidae.

39. **Eupterote crenulata,** sp. nov.

(Plate LXII, fig. 5.)

Allied to *styx*, B.-B., Nov. Zool., xv, 1908, p. 176.

♂. *Upperside* of forewing pale brown entirely suffused with black scaling, more so at costa. A curved black basal line from costa to inner margin; a faint dark band crossing the cell from costa to inner margin, its outer edge crenulate; beyond the cell two dark and faint narrow crenulate discal bands; a heavily-marked waved submarginal black line, separated by the ground-colour from a dark marginal band. Hindwing pale brown with a wide dark marginal area of sparse black scaling. A well-marked dark and waved line crosses the wing from before the apex to inner margin.

Underside of forewing paler than upperside, darker at margin and on costa. A faint black submarginal line from before apex to inner margin, becoming fainter posteriorly. Hindwing darker than above, discal line fainter, and between it and cell two other lines are just perceptible.

Length of forewing: 46 mm.

Two specimens were taken, the second being smaller and paler than the ♂ described.

LASIOMORPHA, gen. nov.
(Plate LXII, fig. 6*a*.)

This genus is allied to *Melanothrix*, Feld., but has a more robust appearance which is similar to some *Lasiocampidae*.

Thorax and abdomen stoutly built. Wings short and broad. Forewing slightly rounded at apex. First subcostal arises well before end of cell opposite vein 2. Third and fourth subcostals and vein 6 at equal distance apart, 6 and 9 arising close together at upper angle of cell. Upper discocellular short, half length of lower ones; middle discocellular curved inward and shorter than the lower. Vein 5 near 6. Hindwing with upper discocellular oblique and longer than the middle, lower one twice length of upper and middle ones. Vein 5 nearer than 7 is to 6. Palpi with first segment conical and porrect.

Type: *Lasiomorpha noakesi*, Joicey and Talbot.

40. **Lasiomorpha noakesi,** sp. nov.
(Plate LXII, fig. 6.)

♂. Ground-colour on both sides deep purplish-brown but pale below. Wings heavily scaled and covered with short hair at base. Forewing with a large hyaline patch which is devoid of scales below but is above sprinkled with scales of the ground-colour. The scales are rather large in the proximal part; they are 4-toothed and their form suggests the calyx of a Labiate plant. The hyaline patch extends from cellule 6 to below submedian without touching inner margin. It is widest in cellule 4 and narrows posteriorly, curving inwardly at the submedian to form a point below it. It is traversed by a dark line parallel to its outer edge which separates a narrow border more thickly scaled than the larger proximal part. There is a small tuft of yellow hair on the middle discocellular. *Underside* without markings, outer margin paler. Hindwing without markings on both surfaces, inner margin paler below.

Head, antennae, thorax and abdomen of same general ground-colour above. Palpi and outside of fore tibiae and femora paler; rest of legs, thorax and abdomen yellowish-brown below.

Length of forewing: 38 mm.

Two examples.

41. **Gunda kebeae flava,** subsp. nov.

♂. Differs from *kebeae*, B.-B.,* in the darker apical part of the forewing, and in having white scaling in the median area and in

* *Gunda kebeae*, B.-B., Nov. Zool., vol. xi, 1904, p. 370.

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NEW LEPIDOPTERA FROM DUTCH NEW GUINEA

Explanation of Plate LV.

Fig. 1. *Papilio tithonus prominens*, ♂.
„ 2. *Leuciacria acuta*, ♀.
„ 3. *Danaida thalassina*, ♂.
„ 4. „ „ ♀.

Explanation of Plate LVI.

Fig. 1. *Papilio tithonus prominens*, ♀.
„ 2. *Delias elongatus*, ♀.
„ 3. *Danaida grosesmithi*, ♂.
„ 4. „ „ ♀.

E. C. Knight ad nat del

Adlard and West, Newman chr.

NEW LEPIDOPTERA FROM DUTCH NEW GUINEA.

NEW LEPIDOPTERA FROM DUTCH NEW GUINEA.

Explanation of Plate LVII.

Fig. 1. *Papilio tithonus misresiana*, ♀.
,, 2. *Platypthima pedaloidina*, ♂.
,, 3. ,, ,, ♀.
,, 4. *Mycalesis fumosus*, ♂.

Explanation of Plate LVIII.

Fig. 1. *Papilio arfakensis*, ♂.
„ 2. *Mycalesis fulvo-oculatus*, ♂.
„ 3. „ *angiana*, ♀.
„ 4. *Praetaxila tessei*, ♂.

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West, Newman chr.

NEW LEPIDOPTERA FROM DUTCH NEW GUINEA

E. C. Knight ad nat. del.

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NEW LEPIDOPTERA FROM DUTCH NEW GUINEA.

Explanation of Plate LIX.

Fig. 1. *Papilio arfakensis*, ♂.
„ 2. *Praetaxila tessei*, ♀.
„ 3. *Dicallaneura angustifascia*, ♂.
„ 4. „ „ ♀.
„ 5. „ *fulvofasciata*, ♀.

Explanation of Plate LX.

Fig. 1. *Morphopsis brunnifascia*, ♂.
,, 2. *Dicallaneura fulvofasciata*, ♂.
,, 3. ,, *exiguus*, ♂.
,, 4. ,, ,, ♀.
,, 5. *Cyaniris drucei*, ♀.
,, 6. ,, *manokwariensis*, ♂.
,, 7. *Telicota fulvomargo*, ♂.

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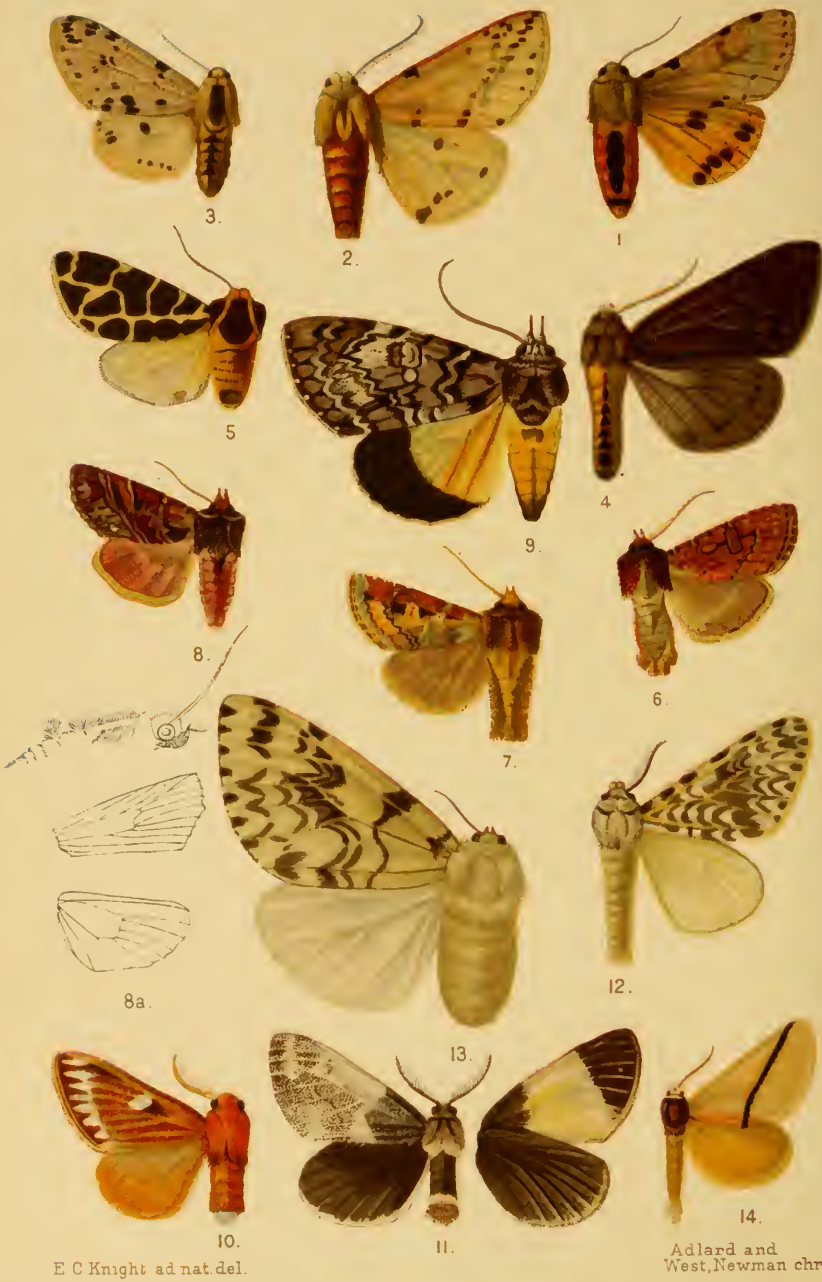
NEW LEPIDOPTERA FROM DUTCH NEW GUINEA.



NEW LEPIDOPTERA FROM DUTCH NEW GUINEA.

Explanation of Plate LXI.

Fig. 1. *Diacrisia rubribasis*, ♂.
„ 2. „ *ruficosta*, ♂.
„ 3. „ *angiana*, ♂.
„ 4. „ *holobrunnea*, ♂.
„ 5. „ *hampsoni*, ♂.
„ 6. *Dasygaster stigma*, ♂.
„ 7. *Trachea brunneicosta*, ♂.
„ 8. *Clavipalpa monogramma*, ♂.
„ 8*a*. „ „ ♂.
„ 9. *Ulotrichopus longipalpus*, ♀.
„ 10. *Euproctis albonotata*, ♂.
„ 11. „ *seminigra*, ♂.
„ 12. *Lymantria flavoneura*, ♂.
„ 13. „ „ ♀.
„ 14. *Epicoma nigrolineata*, ♂.

Explanation of Plate LXII.

Fig. 1. *Dasychira angiana*, ♂.
„ 2. *Colussa inconstans*, ♂.
„ 3. „ „ ♀.
„ 4. „ *angiana*, ♀.
„ 5. *Eupterote crenulata*, ♂.
„ 6. *Lasiomorpha noakesi*, ♂.
„ 6*a*. „ „
„ 7. *Milionia illustris*, ♀.
„ 8. *Sporostigena trilineata*, ♀.

E.C. Knight ad nat del.

Ad. Ard and West, Newman chr.

NEW LEPIDOPTERA FROM DUTCH NEW GUINEA.

cellules 4 and 5. Hindwing with darker markings than in type-form, discal band curved outwardly and projecting at vein 5, submarginal band also curved and sinuate, anal angle and margin white to vein 2.

Underside of forewing without white scaling, hindwing dark purplish traversed by the yellow veins, and white anal area reduced.

1 ♂ only received.

NOTODONTIDAE.

42. **Epicoma nigrolineata,** sp. nov.
(Plate LXI, fig. 14.)

The species of this genus and its allies, formerly referred to Eupterotidae and Lymantriadae, are now placed by Sir Geo. Hampson in the Notodontidae. *Epicoma* has apparently not been previously recorded from New Guinea, being a typically Australian genus.

♂. *Upperside.* Forewing greyish-white with a faint yellowish tinge; costa narrowly orange-yellow; a heavily-marked black postmedial line from just before apex to inner margin and entering lower angle of cell, bordered on both sides by a thin orange-yellow line. Hindwing pale yellow-brown.

Underside pale yellow-brown, costa of both wings darker; postmedial line showing through on forewing.

Head and tegulae clothed with white hair; thorax black; abdomen pale yellow-brown, anal tuft white; femora yellow-brown, tibiae and tarsi black.

Length of forewing: 18 mm.

1 ♂ only received; Angi Lakes.

GEOMETRIDAE.

43. **Milionia illustris,** sp. nov.
(Plate LXII, fig. 7.)

♀. *Upperside* ground-colour black shot with deep blue. Base of both wings metallic greenish-blue. *Underside* ground-colour black more faintly shot with blue than above. Forewing metallic greenish-blue at base, extending to submedian fold and outwardly to origin of vein 2. Hindwing metallic greenish-blue at base, extending to vein 2 with a somewhat rounded and well-defined outer edge, forming a patch nearly twice the size of that on the forewing.

Length of forewing: 19 mm.

This species closely resembles *Craspedopsis angiana* * above.

The only specimen.

Lasiocampidae.

44. **Sporostigena trilineata,** sp. nov.

(Plate LXII, fig. 8.)

This genus was hitherto only represented by *uniformis*, B.-Baker, Nov. Zool., xi, 1904, p. 396.

♀. General colour pale brown and thinly scaled. Forewing with an antemedial waved line; postmedial crenulate line bent outwards from costa to vein 6, then oblique to inner margin; a submarginal more or less waved line at nearly equal distance from margin and postmedial line, marked by 3 heavy spots in 6, 7 and 8; the three lines black and weakly-marked; postmedial and submarginal lines showing through faintly below.

Abdomen yellow-brown, head and thorax darker than the wings.

Length of forewing: 21 mm.

1 ♀ from Angi Lakes.

Zygaenidae.

45. **Aglaope hemileuca,** Roths. ♀.

Chelura hemileuca, Roths., Nov. Zool., xi, 1904, p. 322, pl. 3, fig. 35 ♂.

Similar to the ♂, but without any discal bar or dark apical suffusion.

Length of forewing: 30 mm.

Three specimens, 8 ♂♂ being also obtained.

* *Craspedopsis angiana*. J. and T., Ann. and Mag., Nat. Hist., Ser. 8, vol. xv, 1915, p. 299.

Explanation of Plates LV–LXII.

[*See Explanation facing the* Plates.]

XVII. *Record of some species of the genus* Teracolus *occurring in the Northern Territories of the Gold Coast, W. Africa.* By G. C. Dudgeon, F.E.S.

[Read October 6th, 1915.]

Plate LXIII.

As far as can be ascertained, but few opportunities have occurred for a study of the Lepidopterous insects found in the ultra-forest zone of the West African region north of the equator. This is probably accounted for by the fact that the forest zone is so rich in species, in comparison with the drier tracts, that more attention has been generally given to the former. The genus with which this paper deals is almost entirely a dry country or desert one, and is but poorly represented within the forest limits. Dr. Aurivillius in Seitz, "Macrolepidoptera of the World," vol. xiii, supplies a general account of the distribution of the known species, and the following list gives the actual records in the West African region to as recent a date as at present available. The present paper adds some further species to the list.

Species in Seitz, "Macrolep." :—

T. chrysonome Klug. Bornu (N. Nigeria).
T. doubledayi Hpff. Sierra Leone.
T. amelia Lucas. Senegal.
T. protomedia Klug. Yola (N. Nigeria).
T. eris Klug. Senegal.
T. elgonensis E. Sharpe. N.W. Cameroons.
T. eupompe Klug. Senegal.
T. achine Cr. South of Sahara except in W. African forest region.
T. evippe L. Sierra Leone (forest region).
T. omphale Godt. Senegambia.

Through the courtesy of Capt. Armitage, the Chief Commissioner, I have recently had the opportunity of examining several small collections made by himself in the Northern Territories of the Gold Coast, a country similarly conditioned to parts of Upper Senegal and Northern Nigeria, where thick bush growth does not exist, except in proximity of the large rivers, and where the

country is open and park-like, covered with green grass in the autumn, but, for the most of the rest of the year, dried or burnt over by grass fires and sparsely dotted with trees mainly belonging to the following genera: *Acacia*, *Pseudocedrela*, *Daniellia*, *Lophira*, *Afzelia*, *Butyrospermum* and stunted bush growths of *Bauhinia* and *Combretum*.

It is highly probable that most of the species hitherto recorded from Senegal and N. Nigeria will eventually be obtained from this region, and the present paper does not pretend to be in any way complete.

AMATUS GROUP.

1. **T. armitagei**, n. sp. Fig. 3, ♂ upperside; Fig. 3*a*, ♂ underside; Fig. 4, ♀ upperside.

♂. Both wings white; forewing with a small triangular black spot on the discocellulars and a broad black marginal band, broadest on the costa where it measures 12 mm.; the inner edge of the band excised in interspaces 2, 4 and 5, the excisions filled in with a pale orange-buff suffusion; the following pale orange-buff markings on the black band—a double spot in 1*b* and smaller ones in interspaces 3 and 6, a series of narrow interneural streaks before the margin in interspaces 2 to 7: hindwing, with the broad black marginal band continued, its inner edge crenulate; the following pale orange-buff markings—a large submarginal spot in interspace 6 and traces of spots in 5 and sometimes 7, marginal interneural streaks in interspaces 2 to 6. Underside with the broad black marginal band reproduced as on the upperside on both wings: forewing from the base to nearly the end of the cell orange, the area just beyond white and the markings on the black marginal band lemon-yellow; the submarginal series of spots on the band as follows—a double spot in 1*b*, one each (minute) in 3 and 5 and in 6, 7 and 8, that in 7 narrow; a marginal row of evenly rounded spots increasing in size from interspace 2 to 6 and a similar spot in interspace 7: hindwing with the costa orange as far as the end of vein 8, the light portion of the wing and all the spots lemon-yellow, an orange bar from vein 8 to the origin of vein 7, an L-shaped orange mark in the cell and orange streaks along veins 1*b* and 1*c*; yellow spots on the band in interspaces 5, 6 and 7 and yellow scales in the lower interspaces; a complete marginal series of large rounded yellow spots from 1*b* to 6.

♀. Differs from the male in being without the orange-buff suffusion and in the colour of the markings on the band, which latter are white and reduced in size; two specimens show no interneural

marginal streaks on the upper side of the hindwing. Underside similar to that of the male but paler. Cilia of both wings dark.

Exp. 56–60 mm.

Hab. Northern Territories, Gold Coast.

This species is described from seven examples obtained by Capt. Armitage. Both sexes bear a close superficial resemblance to the female of *Pieris creona* var. *sigirrensis* Strand, Fig. 5, which is a common insect in the same locality. This species most nearly approaches *catachrysops* (Seitz, xiii, pl. 16*c*) on the upperside, but the submarginal series of spots on both wings is nearly obsolete, the insect is much larger and the broad black marginal band is identical on the upper and under sides of both wings in *armitagei*; also, only the base of the forewing is orange in this species. Professor Aurivillius regards *catachrysops* as one of the forms of *vesta*, of which species, unless we include *amelia*, Lucas, no form has hitherto been recorded from W. Africa. In some respects *armitagei* has perhaps more affinity to *amelia* than to *catachrysops*, which former species, Aurivillius remarks, is perhaps only another race of *vesta*. In *amelia* the discal band of the hindwing is said to be placed far behind the middle and to be almost confluent with the marginal band, so that the submarginal spots are small. In *armitagei* there is no separable discal band, the only band being the broad marginal one from which the pale spots are for the most part absent. Both species have the cell of the forewing beneath orange, but in *amelia* the veins of the hindwing are said not to be darkened, whereas veins 1*b* and 1*c* in *armitagei* are orange where they traverse the pale area. It is probable that *armitagei* may prove to be an extreme form of *amelia*, but I have not had the opportunity of seeing a specimen of the latter, which is only known to me from the short description here referred to.

EVIPPE GROUP.

2. **T. ione** Godt. Fig. 1, ♂ upperside; Fig. 1*a*, ♂ underside; Fig. 2, ♀ upperside; Fig. 2*a*, ♀ underside.

This insect is apparently common in the spring and early summer in the Northern Territories, numerous specimens of both sexes having been sent me by Capt. Armitage, all of which seem constant. They differ from the figure given in Seitz (pl. 17*b*), in that the veins on the upperside

of the hindwing are distally black and terminate on the margin in triangular black spots, which are connected by a fine black marginal line (similar to that shown in the figure of *bacchus* (pl. 17*b*). *The veins of the hindwing on the underside are not black*, which character separates it from *bacchus*. The females are in every case exactly similar to the figure of the female of *bacchus* (Seitz, pl. 17*b*), and quite unlike that of *ione* shown on the same plate.

3. **T. eupompe** Klug.

One female only was received. The characteristic radiating terminal black streaks on both wings, the dark basal suffusion and the discal row of pink spots on the underside of the hindwing are well pronounced in the specimen.

4. **T. achine** Cr.

Two males only received which appear to belong to the race *antevippe*, Bdv. The ornamental spot is large, orange and triangular without a proximal black border. There is no hind-marginal stripe, and the underside is white. The hindwings above in both examples have a terminal conjoined row of triangular black spots on the veins.

5. **T. evippe** L.

Two males and one female quite typical.

6. **T. antigone** Bdv.

A large number of both sexes of this species were received, corresponding completely with the race *phlegetonia*. In some the marginal row of spots on the hindwings consists of a disunited series of triangular marks, in others all are merged into a broad marginal band leaving an interneural series of white streaks.

Explanation of Plate LXIII.

Fig. 1. *Teracolus ione* Godt. ♂, upperside, nat. size.
„ 1*a*. „ „ „ „ underside „
„ 2. „ „ „ ♀ upperside „
„ 2*a*. „ „ „ „ underside „
„ 3. „ *armitagei* n. sp. ♂ upperside „
„ 3*a*. „ „ „ „ underside „
„ 4. „ „ „ ♀ upperside „
„ 5. *Pieris creona* var. *sigirrensis* ♀, upperside, nat. size.

G. C. Dudgeon, photo. *Anglo-Engraving Co., Ltd.*

WEST AFRICAN FORMS OF TERACOLUS, etc.

XVIII. *A New* Micropterygid *from Australia.* By A. Jefferies Turner, M.D., F.E.S.

[Read October 6th, 1915.]

Hitherto the only species of the family *Micropterygidae* recorded from Australia is *Sabatinca* (*Palaeomicra*) *calliplaca* described by Mr. Meyrick in the Entomologists' Monthly Magazine, vol. 38, p. 60 (1902). I first discovered this pretty little species on Mount Tambourine, settled in large numbers on the flowers of a small shrub. Since then I have taken it freely, flying during the day in shady places like a *Glyphipteryx* in the same locality, and also at Montville (1500 feet), sixty miles north of Brisbane. I have also received several examples taken at Kuranda near Cairns by Mr. F. P. Dodd. Structurally it is identical with New Zealand species of *Sabatinca*, but I am unable to distinguish any mandibles. Any addition to our knowledge of this the most primitive family of Lepidoptera, especially when it constitutes a new genus with complex relationship to those hitherto known and to the *Hepialidae*, is of special interest.

On the 12th of October 1902, as I was beating the undergrowth along a track through the jungle on Mount Tambourine (1800 feet, thirty-five miles south of Brisbane) in Southern Queensland, a small moth darted out and settled on my coat, from which I boxed it. Had it settled elsewhere I doubt whether I should have seen it. At the time I took it for a small Hepialid, to which family it would undoubtedly be ascribed from its general appearance. Its neuration is almost identical with *Fraüs*, Wlk., and even the presence of four well-developed spurs on the posterior tibiae did not seem sufficient by itself to distinguish it from this group. I was, however, struck by the curious structure of the antennae, and on mentioning this to the late Mr. Ambrose Quail, who had been paying special attention to the antennae of the *Hepialidae* and *Micropterygidae*, he at once referred the species to the latter group. Looking into the matter myself I agreed with him, and, if there had been any doubt the discovery of

an extra vein arising from 12 of the forewings, a primitive Micropterygid character, would have settled it. It is, however, a small giant in this family measuring 18 mm. across. As no further material has come into my hands since the first capture I propose to describe the genus and species without further delay.

Gen. Anomoses, nov.

(*ἀνομος*, not according to rule; *σης*, a moth.)

Head with loosely spreading hairs. Antennae very short (¼); basal joint somewhat thickened, not tufted; each joint with a whorl of short forwardly directed bristles from its base. Mandibles not developed. Tongue obsolete (?). Labial palpi well developed, about 1½, slender, porrect, with a few long hairs beneath. Maxillary palpi long, folded. Legs rather stout and long, hairy; tarsi proportionately long; middle tibiae with apical long hairs, spurless; posterior tibiae with two pairs of long slender spurs, first pair slightly beyond middle, second at apex. Forewings with 1*a* obsolete, 1*c* obsolete (?), 2, 3, 4, 5 and 6 apparently separate, the parting vein in cell well developed in its posterior ⅔ and the fork which gives rise to 3 and 4 so obtuse as to appear continuous with discocellular, 7 and 8 stalked for a short distance, 7 to termen, 9 and 10 stalked nearly to wing margin, 11 from ⅔, 12 giving off a short vein from its middle; length of cell about ⅔. Hindwings with similar neuration to forewing, but 2 and 3 more closely approximated at base, parting vein in cell well developed from base, stalking of 7 and 8 longer, 12 not giving off a branch vein.

The absence of mandibles and well-developed labial palpi show that this genus belongs to Mr. Meyrick's subfamily *Eriocraninae* (*Eriocrania* type species *semipurpurella*, Stph.), although it resembles the *Micropteryginae* (*Micropteryx* type species *aruncella*, Scop.) in the absence of spurs on middle tibiae. The neuration is specialised for this group, especially in the reduction of the internal veins, which resemble those of *Mnesarchaea*, but is primitive in the presence of an extra vein arising from 12 as occurs in all the recognised genera of *Micropteryginae*. The additional vein arising as a branch from 11 present in *Mnemonica* and *Sabatinca* is, however, absent. In the long-stalking of veins 9 and 10 it approaches *Eriocrania*, in which these veins are coincident, and is specialised as

compared with the *Micropterygina*. *Anomoses* is, I believe, particularly interesting as indicating the origin of the *Hepialidae*. Its size and shortness of antennae together with its general facies are similar, and the neuration of the forewings is exactly that of *Fraüs*, Wlk. (*Hectomanes*, Meyr.), except for the presence of the extra vein arising from 12.

Anomoses hylecoetes, n. sp.

(ὑλητκοιτης, lurking in the woods.)

♂. 18 mm. Head, palpi, antennae, thorax, abdomen, and legs pale ochreous-brown. Forewings broadly lanceolate, costa moderately arched, apex rounded, termen very obliquely rounded; whitish-ochreous sparsely irrorated with fuscous-brown which forms transversely directed spots and blotches; a subdorsal crest of long scales close to base; cilia whitish-ochreous. Hindwings lanceolate; grey; cilia grey-whitish.

Type in Coll. Turner.

QUEENSLAND: Mt. Tambourine, in October; one specimen.

XIX. Glossina morsitans, *Westw.: Some Notes on the Parasitisation of its Pupae.*

By Hereward C. Dollman, F.E.S., Entomologist to the British South Africa Company.

[Read October 6th, 1915.]

Plate LXIV.

Although as yet my work on this particular subject is incomplete, such results as I have definitely arrived at are perhaps of sufficient importance to be recorded.

This note concerns a high percentage parasitisation of the pupae of *Glossina morsitans* by a small species of *Mutilla*. The latter, from material sent by me to the Keeper of the Insect Department of the British Museum, and submitted by him to Mr. Rowland Turner, F.E.S., has been described as a new species, under the name of *Mutilla glossinae*, Turner (*vide* Bull. Entom. Research, v, p. 383, 1915). The locality where the work was carried out is the district of Namaula, situated between the Government stations of Namwala and Mwengwa, in proximity to the Kafue River, N.W. Rhodesia. The exact locality of the parasites I hatched out is not easily capable of reference; this is so because I was encamped some miles from any native village, and away from any river, kopje, or other noticeable geographical feature. The nearest native village was that of Shimukuyela, some six or seven miles away; the "Namaula district" comprises by no means a large territory, however, and is, for all practical purposes, no doubt sufficient. The pupae of *Glossina morsitans* were found under, or very closely adjacent to, felled or fallen trees, in such situations as were found so fruitful by Mr. Lloyd in 1913. In my limited experiences of pupa-hunting for tsetse, I was, in this district and at this time, rewarded far more lavishly than has been my good fortune before or since.

Of the large number of pupae taken (for so very brief a period), some seventy-five per cent. were sifted out

from the close vicinity of two large, and one small, felled trees; the three trees being within two hundred yards of one another.

In each instance the tree was old and dry, and in the case of one of them, heavily charred by the recent fires. The other pupae were collected by natives from the immediate district (one or two miles) from an apparently similar habitat.

In reference to "big game" in the close vicinity of this highly favoured "breeding-ground," I may safely say that there was an abundance. A large herd of eland, herds of water-buck and sable antelope, hartebeest (*Bubalis lichtensteini*) in numbers, a small herd of kudu, some twenty zebra, two or three pairs of oribi and of reed-buck, and innumerable wart-hog, were all seen certainly within one mile of the locality during my brief stay there.

The sand around the "breeding-ground" was impressed with the "spoor" of many animals, particularly that of pig and eland. In addition, the carnivora were represented by a pack of lions (which, on one night at any rate, numbered at least eight), hyena, and jackals.

I have dwelt somewhat fully on the "big-game"; to me it seemed a noteworthy fact, particularly considering the almost entire absence (normally) of Bantu from the neighbourhood. The only native path for some miles was hardly discernible, and obviously but very little frequented.

The type of country is one very familiar to those who know this part of Northern Rhodesia. Tall, slender timber, for the most part leguminous in character ("Mopani" and its allies), the shrubby *Bauhinia*, an occasional "Baobab," and ever and again a group of isolated palms; the undergrowth, a comparatively sparse and untangled vegetation. Relief from seemingly interminable stretches of such forest country is to be welcomed in the open "vleis," or the uncouth rugged formation of sporadic kopjes.

My work was done at the end of August and the beginning of September; at this time most of the undergrowth among the timber, and the long grass of the "vleis," had been destroyed by the all-consuming "veld-fires."

The first emergence of *Mutilla glossinae* was noted on August 28th; on this day three ♂♂ appeared in the breeding-jar. The last date upon which one of the parasites

hatched was September 9th. I append a brief table of the period included between these two dates.

TABLE TO SHOW THE DATES OF EMERGENCE OF THE ♂ AND ♀♀ *Mutilla glossinae.*

Date.	♂ *Mutilla.*	♀ *Mutilla.*
August 28th . . .	0	3
,, 29th . . .	0	1
,, 30th . . .	0	9
,, 31st . . .	0	0
September 1st . .	0	14
,, 2nd . .	0	11
,, 3rd . .	1	17
,, 4th . .	0	2
,, 5th . .	0	3
,, 6th . .	0	1
,, 7th . .	0	0
,, 8th . .	0	0
,, 9th . .	0	1

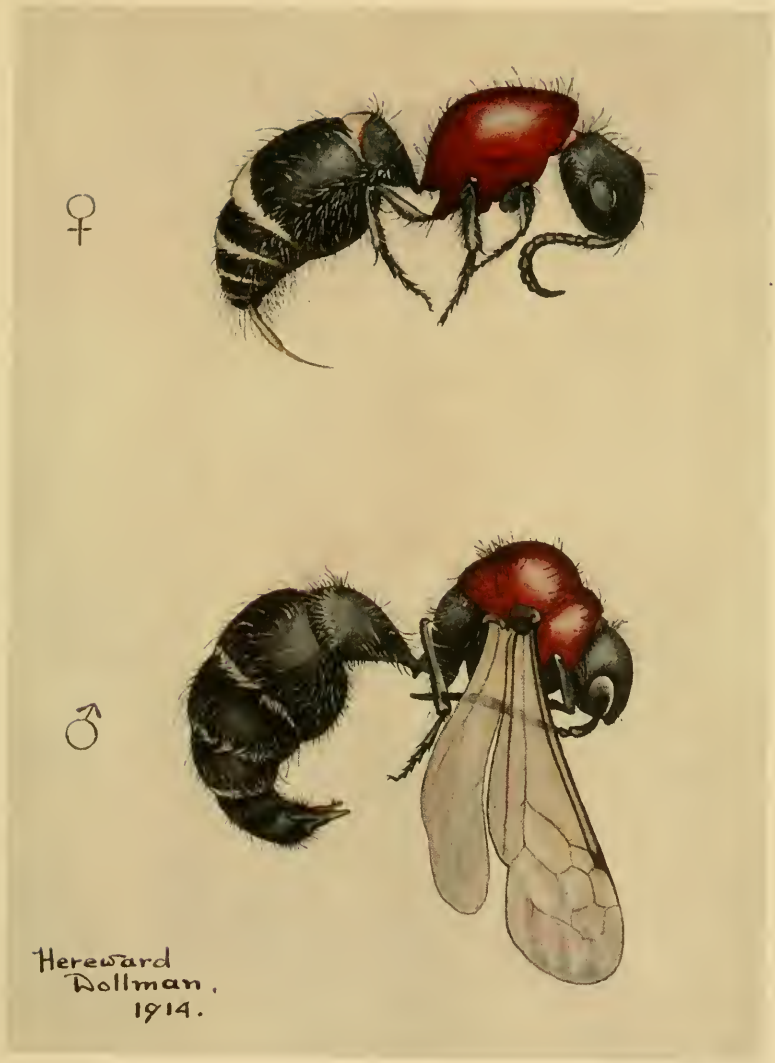
It will be noticed that the disproportion of the sexes was very marked indeed; sixty-two females to one male.

I may mention that when I found it necessary to finish up the work in mid-September, I dissected the remaining unhatched pupae to ascertain whether they were, or were not, playing the part of hosts. In no pupa was I able to determine a parasite, *Mutilla* or otherwise; several of the pupae had obviously "dried-up," while with others the incipient imago had suffered casual injury.

Unfortunately I found it necessary to return to my station at Mwengwa during September, to be in readiness to trek to Kashitu. Hence the work was left incomplete, and here, as yet, the breeding-season of tsetse has evidently not thoroughly commenced.

EXPLANATION OF PLATE LXIV.

FIG. 1. *Mutilla glossinae*, Turner ♂.
2. ,, ,, ,, ♀.



Andre, Sleigh & Anglo, ltd.

MUTILLA GLOSSINAE.

XX. *On the early stages of* Latiorina (Lycaena) pyrenaica, *Boisd.* By T. A. Chapman, M.D.

[Read October 6th, 1915.]

Plates LXV—LXXXII.

My first critical examination of *L. pyrenaica* is recorded in the Trans. Ent. Soc. Lond. 1905, p. 307, and in the Transactions for 1911, p. 148, I was able to give some facts as to the early stages of *L. orbitulus*. Since rearing *L. orbitulus*, it seemed that it would be very desirable, if possible, to learn something of the life-history of *L. pyrenaica*, but it was only last year (1914) that I was able to make an effort to put this desire into action. As a matter of fact, whatever the truth may be, I persuaded myself that I selected Gavarnie, rather than any other place amongst the hills, for an excursion in July 1914, entirely in order to investigate the life-history of *L. pyrenaica*.

One is seldom as successful as one wishes to be, but I succeeded in following out the main outlines of the earlier stages of our butterfly, notwithstanding various difficulties, some anticipated, some wholly unexpected.

Accepting the close relationship of *pyrenaica* to *orbitulus*, the presumption was very strong that it fed on some primulaceous plant. Visiting several localities where I knew *L. pyrenaica* to occur, I soon found that they all agreed in having *Androsace villosa* as a substantial part of their flora; the other Androsaces and Primulas found at Gavarnie were usually absent from such localities. Several spots where *A. villosa* grew, even sparsely, but where I did not know *L. pyrenaica* to occur, afforded specimens of that butterfly on a little patient examination.

The first specimens of the butterflies (two males) were seen on July 14, but it was in the third and fourth weeks of July that the species was fully out. During this period eggs were obtained by placing the females with plants of the *Androsace*, and one specimen was seen laying on it in the field, others examined it, with that object no doubt, but a deposited egg was not found. I have to thank M. Rondou for showing me one or two localities for *L. pyrenaica* that

I had not previously visited, which materially assisted me in obtaining eggs.

The eggs are laid in the little rosettes of leaves of the food-plant, right down between the leaves, so as rarely to be visible without separating them, and often as near the centre as affords leaves large enough to have openings between them, but also further out and even on quite outside leaves.

On my last day at Gavarnie (August 1st) I obtained some more butterflies in order to secure a further supply of eggs, but on the 2nd I left Gavarnie and was a week on the way home. By good luck it happened that none of the eggs I had obtained hatched until just as I got home on the afternoon of August 9th, or so immediately before that they managed to find food in the plants on which the eggs had been laid.

The egg of *pyrenaica* is 0·625 mm. in diameter, the margins well rounded from the upper to the under surface, the top itself being somewhat dome-shaped, not flat as in many *Agriades*. The micropylar area is about 0·125 mm. across, and has about seven cells that would be crossed by a line from centre to circumference, but they are hardly regular enough to say there are seven circles. The cells of the network are about 0·03 mm. in diameter, the lines of netting have hardly any eminences at their junctions on top, but these are present though small on the sides.

Comparing this egg with that of *orbitulus* (see Trans. Ent. Soc., 1911, Pl. XII), we find that the size and form are in very close agreement. But in other respects the differences are considerable. In *orbitulus*, the micropylar area is much smaller, only about half the diameter, 0·064 mm. instead of 0·125 mm., and the number of cells make only four or five rings, if we count them in the circles they don't quite arrange themselves in. Even though it be inaccurate to talk of circles, there are nevertheless seven cells from centre to margin counted in the same way as only give four or sometimes five in *orbitulus*. Similarly, there are about seven cells from the micropylar area to the margin in *pyrenaica*, where similar counting gives quite nine in *orbitulus*. The cells are smaller in *orbitulus*, look much more numerous, and have much more fully-developed prominences or pillars where the lines of network meet.

The following notes as made refer to the rearing of the larvae, etc. :—

Aug. 9th, 1915.—On arrival home from Gavarnie, found an egg that was discovered naturally laid had hatched, and from the situation of some traces of frass it was obvious that the larva had penetrated into the centre or base of the central bulb of leaves. An examination of other eggs led to the belief that none had hatched.

Aug. 10th.—Found that several eggs of *pyrenaica* had hatched, and the bulbs in which they were being very wasted, the larva were extracted and placed on growing plants. The larvae in one or two cases were free and newly hatched, but several were found beneath the central growing point in the top of the stem; sometimes a trace of frass showed where it had entered, in other cases there was no indication externally; the place seemed to be between what was the nearly solid central ball and one of the next free leaves. The other eggs (unhatched) were placed one each on the bulbs of growing plants.

Aug. 13th.—All the eggs appear to have hatched; here and there a little frass shows where the larvae have disappeared, but for the most part there is no indication of what has become of them, though they are no doubt in the tops of the stems just below the growing point. In one case only, a larva is seen in the interior of one of the larger leaves, where it has mined out all the green material, leaving the colourless, translucent cuticles.

Aug. 20th.—Found various heads of *Androsace*, with the centres loose and dead, the larvae having eaten their bases; in several cases the larvae were seen, apparently (but not certainly) still in 1st instar; in other cases the larvae had either gone off elsewhere or had eaten down into the root stock, as was suggested by frass covering the centre when the dead central bud was removed. One larva seen was very fat, nearly black, and very glabrous and shining; another had black with paler longitudinal stripes, the black predominating; in two cases, the central loose bud being removed, the larvae were seen to be in the interior of an adjoining leaf.

Aug. 21st.—A larva not wholly black has a broad black dorsal band, then a pale band, then a broad black band down to lateral flanges, the hairs of which are on a large pale patch in each segment. The dark band on slope has various pale spots, especially a large patch about the middle of it (on each segment); the length of the larvae is barely 2 mm. stretched. Head black, legs black, but the plates too thin

and translucent, except at ends, to prevent their looking paler from contents. They are still in 1st instar; the black pigment is in the subcutaneous layer.

Aug. 31st.—Found three larvae of *L. pyrenaica* on two of the plants of *Androsace villosa* sent home to establish a few plants for further necessities. The eggs of these must have withstood the perils of travel to which the plants were subjected. Roughly rolled in paper and sent by sample post, which had very satisfactory results as regards the plants, and, in this instance, without damage to the eggs of *L. pyrenaica*. It is not unlikely that other plants also had on them some eggs which did suffer, at any rate no other stock plant sent home shows any trace of larvae of *L. pyrenaica*.

Aug. 31st.—A larva is detected obviously in 2nd instar; it is very dark, there is a dorsal paler (dark cinereous) line with a broader quite black line on either side of it down the dorsal flanges, below this another dark cinereous band, and below this (from above middle of slope downwards) the black is relieved by various cinereous mottlings. The hairs are rather larger and more conspicuous than in 1st instar. This larva is just under one side of a central bulbil that has been a good deal eaten and destroyed.

Sept. 9th.—Various larvae can be found apparently about full grown in 2nd instar; they still mine out the interior of the small leaves.

At this same date *escheri* hatched same time are full grown in 3rd instar and thinking of hibernating, some having stopped feeding.

The larvae continued to grow slowly, sometimes they fed under the central bud, in other instances they were seen actually inside the larger leaves, which they mined out more or less completely; some rosettes had all the leaves so cleared out, leaving merely the cuticle, both upper and under, in the form of the leaf, but nearly colourless instead of green. As they approached their full growth, in 3rd instar, for hibernation they were very difficult to see or find.

They were placed for the winter on their food-plants, undisturbed, just as they had hidden themselves, some out of doors, some in a refrigerator, and some in a cold room. A certain number survived the winter, but I failed to get any of them to commence feeding in the spring.

Oct. 6th.—The larvae are not to be seen, but the plant

E. J. Knight, del. et pinx. Adlard & Son and West Newman

LARVAE OF L PYRENAICA.

1.

2.

3.

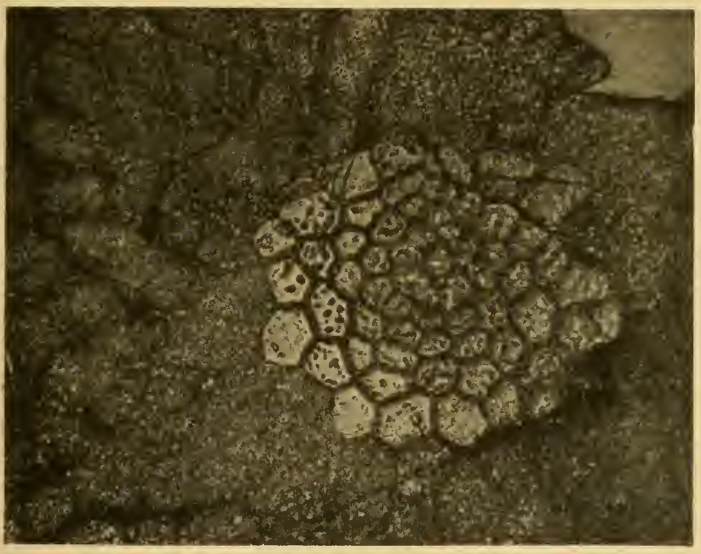
4.

E. C. Knight, del. et pinx. Adlard & Son and West Newman

SKINS OF PARASITISED LARVAE, P. EROS & L. PYRENAICA.

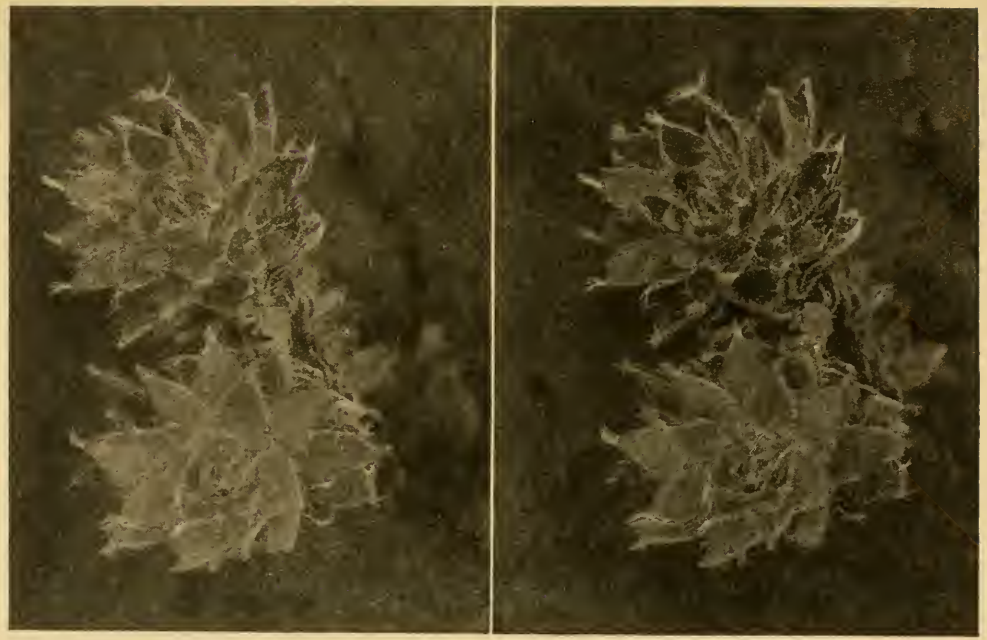
Photo, F. N. Clark. *Anglo-Engraving Co., Ltd.*

L. PYRENAICA, EGGSHELLS × 60.



Photo, F. N. Clark. *Anglo-Engraving Co., Ltd.*

L. PYRENAICA, EGG AND MICROPYLE × 60 and × 350.



Photo, A. E. Tonge. *Anglo-Engraving Co., Ltd.*

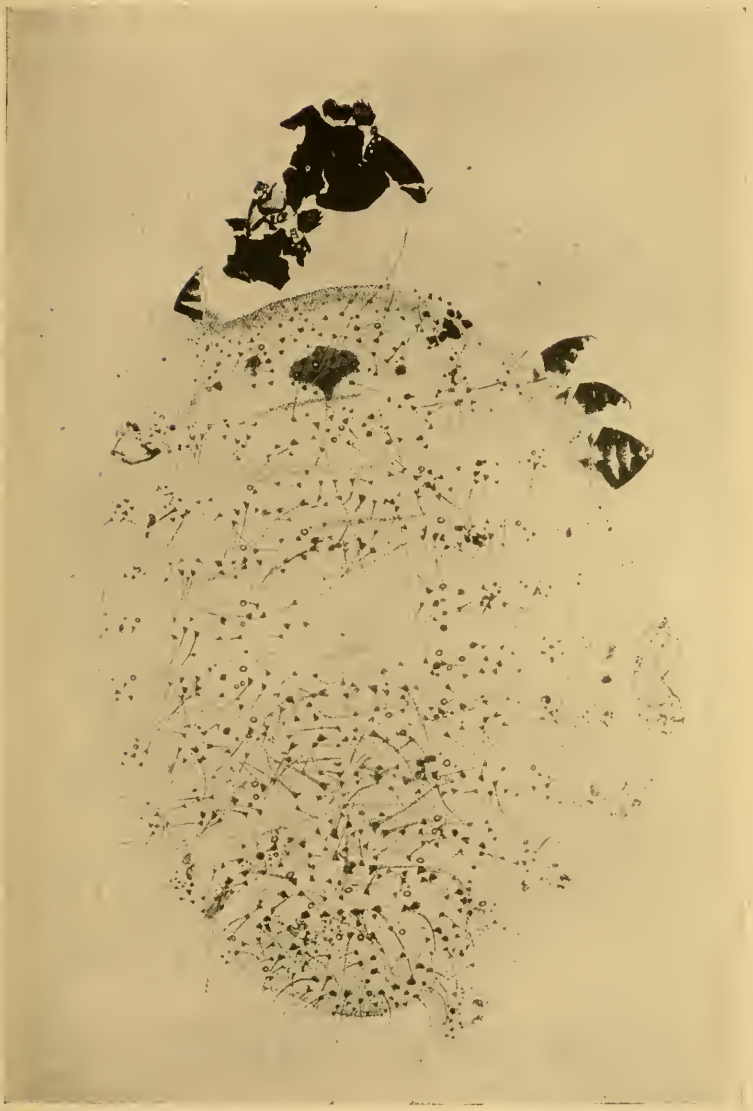
L. PYRENAICA, ROSETTES OF A. VILLOSA WITH EGGS. STEREOSCOPIC × 5.

Photo, F. N. Clark. *Anglo-Engraving Co., Ltd.*

L. FYRENAICA, SKIN OF FIRST STAGE LARVA × 60.

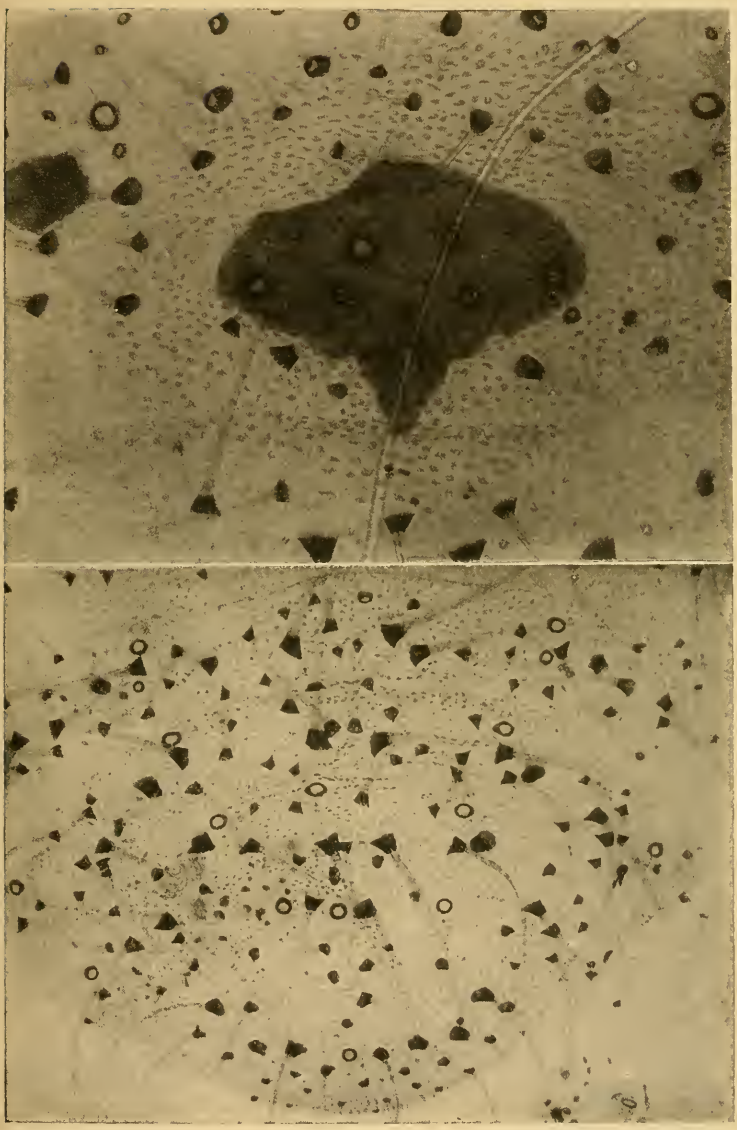
Photo, F. N. Clark. *Anglo-Engraving Co., Ltd.*

L. PYRENAICA, FIRST STAGE LARVAL SKIN × 60.



Photo, F. N. Clark. *Anglo-Engraving Co., Ltd.*

L. PYRENAICA, SKIN OF SECOND STAGE LARVA × 36.



Photo, F. N. Clark. *Anglo-Engraving Co., Ltd.*

L. PYRENAICA, SECOND INSTAR PROTHORACIC PLATE × 200.
LAST SEGMENTS × 100.

Photo, F. N. Clark. *Anglo-Engraving Co., Ltd.*

L. PYRENAICA, LAST STAGE LARVA SKIN × 9.

Photo, F. N. Clark. *Anglo-Engraving Co., Ltd.*

L. PYRENAICA, PROTHORAX AND HONEY GLAND REGION, LAST INSTAR × 100 and × 50.

Photo, F. N. Clark. *Anglo-Engraving Co., Ltd.*

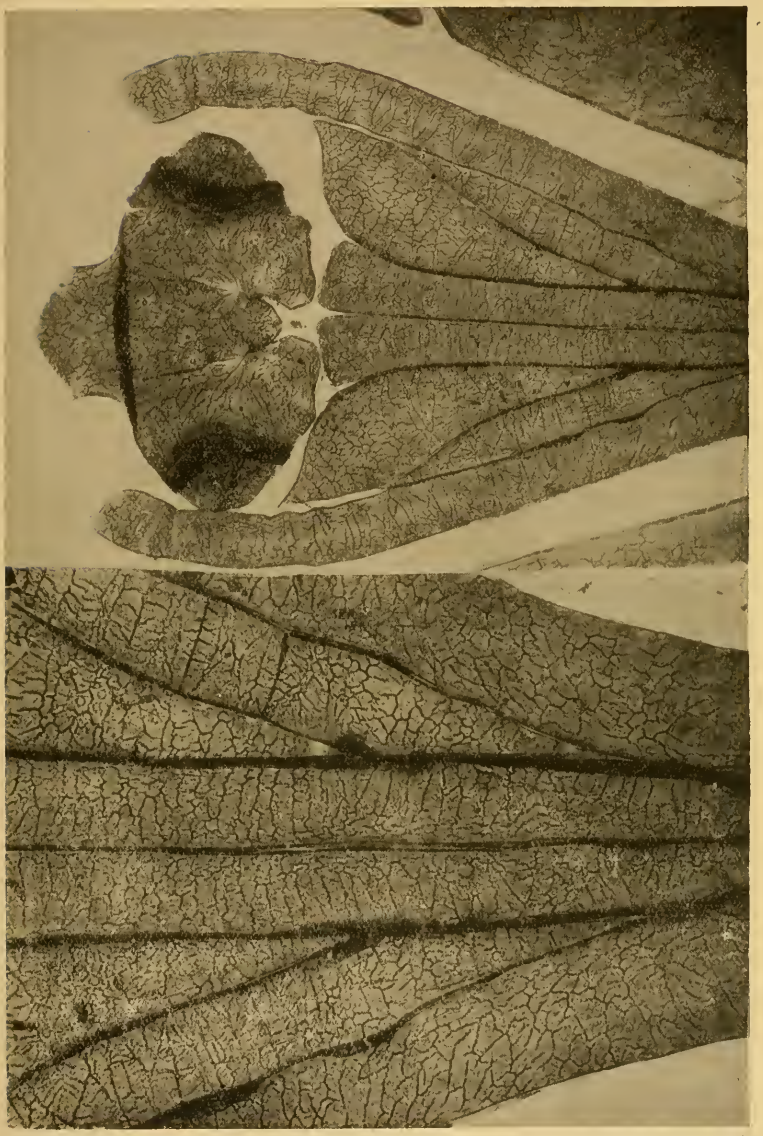
L. PYRENAICA, LAST INSTAR, LAST SEGMENTS, HAIR, AND SPECIAL STRUCTURE.

Photo, F. N. Clark. *Anglo-Engraving Co., Ltd.*

L. PYRENAICA, TWO OTHER SPECIMENS AS ON LAST PLATE, Fig. 3.

Photo, F. N. Clark. *Anglo-Engraving Co., Ltd.*

L. PYRENAICA, PUPAL SKIN, PROTHORAX, Etc. ×6½ and × 30.

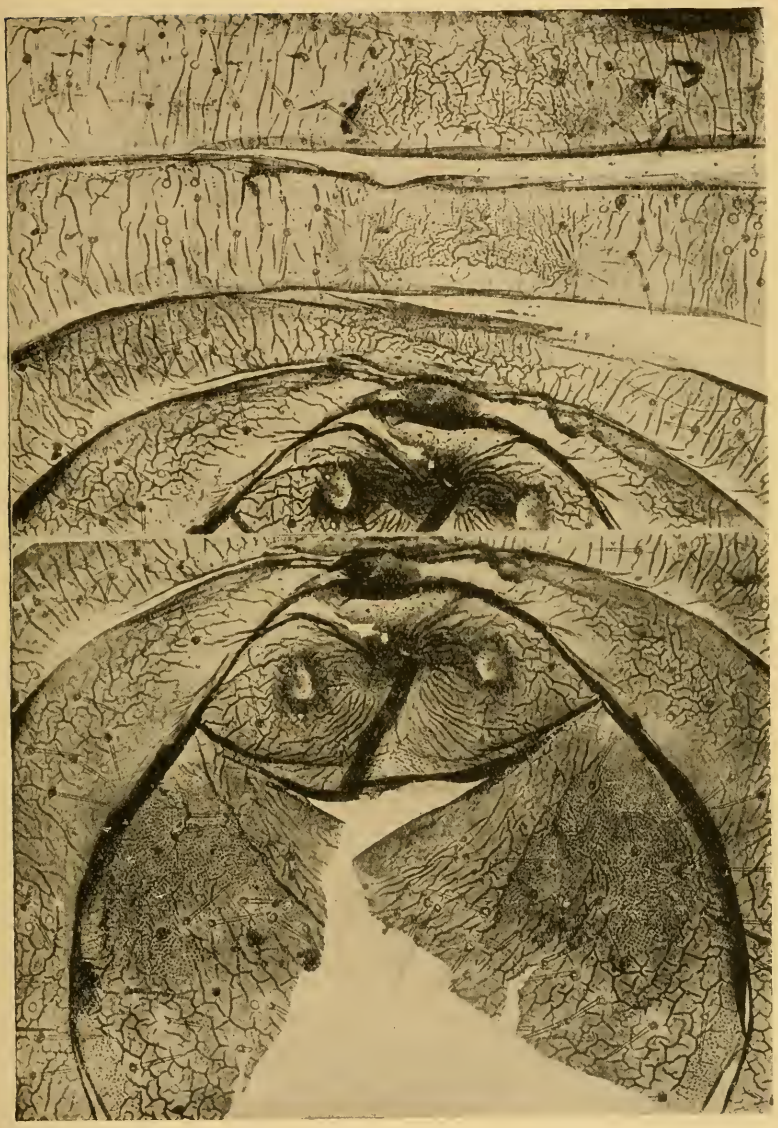


Photo, F. N. Clark. *Anglo-Engraving Co., Ltd.*

L. PYRENAICA, PUPAL SKIN, HEAD AND APPENDAGES
× 20 and × 50.

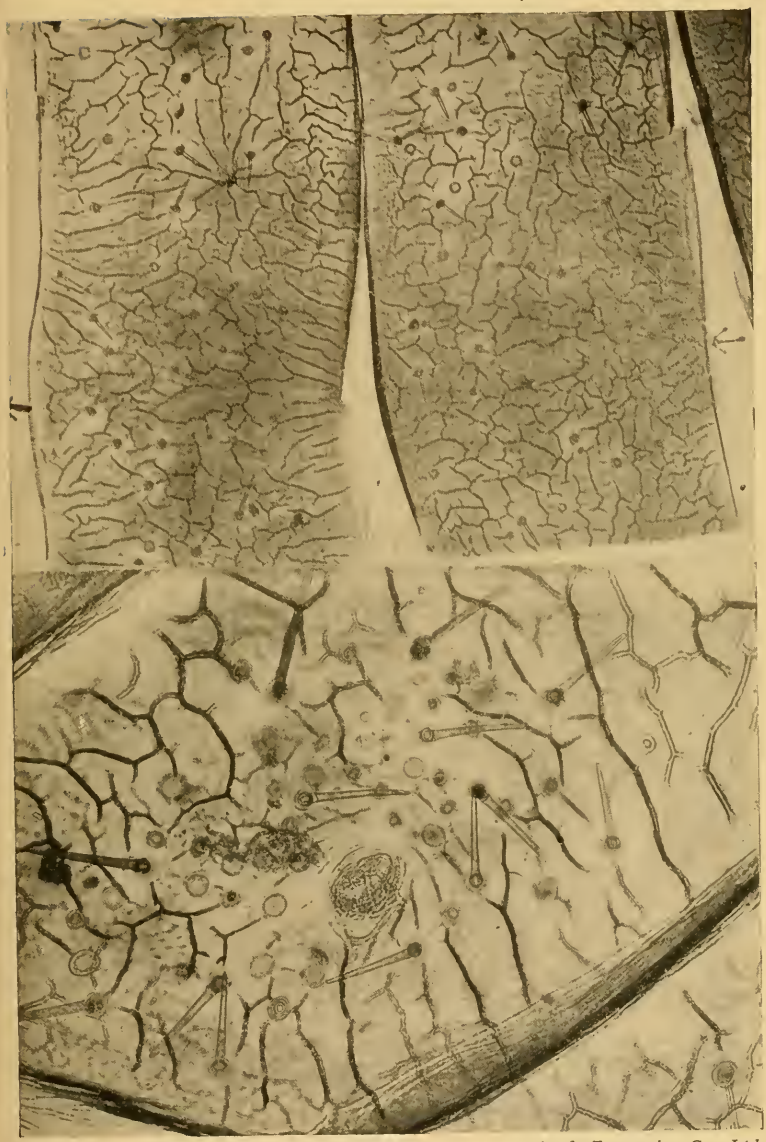
Photo, F. N. Clark. *Anglo-Engraving Co., Ltd.*

L. PYRENAICA, PUPA, METATHORAX AND PORTION OF WING × 30.



Photo, F. N. Clark. *Anglo-Engraving Co., Ltd.*

L. PYRENAICA, PUPA, VENTRAL ASPECT OF ABDOMEN, AND CREMASTRAL AREA × 50.



Photo, F. N. Clark. *Anglo-Engraving Co., Ltd.*

L. PYRENAICA, PORTIONS OF SEGMENTS OF PUPA × 50 and × 100.

that has most on it is being destroyed in a way that shows they are still active.

Oct. 12th.—The plant referred to in last note is much destroyed, but a visit at midnight did not result in any larvae being seen. The heads or crowns of the plant have their centres eaten out, and these seem to die off, the leaves that remain becoming dead and brown. The larvae must, of course, be hiding somewhere amongst the old leaves and stems beneath the living (or now dead) surface of the plant.

The first-stage larva has hairs, lenticles, etc., as shown in Pl. LXX and LXXI. On comparing these with the same stage of *L. orbitulus* (Trans. Ent. Soc. Lond. 1911, Pl. XIII), there is seen to be a difference much greater than might have been anticipated from the close relationship of the two species. At first glance, the much greater size and boldness of the hairs and hair bases in *L. orbitulus* is striking. On coming to details we find this is very marked in the first dorsal hairs on each segment, the base of which is very large in *orbitulus*, small and delicate in *pyrenaica*; even more important, the second hair, which almost rivals the first, is actually wanting in *pyrenaica*. Curiously, the small accessory hair at the front margin of the segment is much the same in both species. The third hair (supra-spiracular) compares in the two species much as the first, bold and strong in *orbitulus*, delicate in *pyrenaica*. The three marginal (sub-spiracular) hairs are, like the others, weak in *pyrenaica*, but they differ also in position; in *orbitulus* the middle one, as in most of these larvae, is ventral to the other two, but otherwise in an intermediate position; in *pyrenaica* it is almost directly ventral to the posterior hair. So far these details refer rather to the abdomen. On the thorax, the metathorax is, in *pyrenaica*, similar to the abdominal segments; in *orbitulus* it differs from them in possessing a hair in front of I and II that emulates them in size, and may or may not represent the very minute front hair of the abdominal segments. On the mesothorax the hairs have the same arrangement in both species, except that *pyrenaica* has only three (sometimes two only) instead of four marginal hairs. The hairs on the prothorax are the same in both, but look very different owing to their slenderness and minute bases in *pyrenaica*, and this is enforced by the absence of the pair of lenticles on the prothoracic plate, present in nearly all first-stage Plebeiid larva. This absence of lenticles affects other segments also. The dorsal lenticle is absent

on the mesothorax (comparison is with *orbitulus*). The metathorax to the 7th abdominal segment have each one dorsal lenticle (on each side). *Orbitulus* has two on 2nd to 6th abdominal segment; but the figure referred to shows that there is a tendency to lose them even on *orbitulus*, as evidenced by the 2nd abdominal segment having two on one side and only one on the other. Two on the 1st abdominal segment also is the rule in Plebeiids. *Pyrenaica* has no lenticles on the 7th and 8th abdominal segments or any marginal ones—a very unusual difference, not only from *orbitulus* but from the usual Plebeiid pattern. The crochets of the prolegs and claspers are two in number as in *orbitulus*, and like it have one larger than the other, but not at all so markedly.

March 13th, 1915.—Three larvae found on principal (dead) mass of *Androsace*. Put on living plants one looks well, but two have been attacked and killed by Dipteron larvae.

April 24th.—No further larvae have been found to have survived the winter. The one that looked well (13 iii.) died when placed on a growing plant.

The dipterous larvae are those of " a species of *Sciara*." " They probably feed in the larval stage on decaying vegetable matter, and will not interfere with your lepidopterous larvae " (J. S. Collin, in letter, Oct. 20, 1914).

That the proper food of these *Sciara* larvae is decaying vegetable matter is from my own observations unquestionable, but they also show that when they reach a quiescent lepidopterous larva, in suitable conditions of moisture and temperature, they attack and destroy it.

Mr. Knight's drawings of the larvae in their hibernating stage, Pl. LXV, figs. 1 and 2, show how dark the larva is in its autumnal stages, as compared with those of *L. orbitulus*, which takes an autumnal colouring very much the same as it has in its mature instars.

This seemed to bring my investigations to an abrupt termination, since it was practically out of the question to think of visiting the Pyrenees in 1915. But a friend in need is a friend indeed. Monsieur Rondou, though weighted with various extra duties and anxieties owing to the war, managed to devote a little leisure to finding the larva in the spring, and generously sent me the five examples he obtained.

A portion of Monsieur Rondou's letter accompanying the

larvae tells how he found them, and therefore requires quotation.

" *Gèdre*, 14 *juin*, 1915.

" Une course à Pouey Aspé le 10 ayant été infructueuse, je suis revenue hier à Estaubé. Comme d'habitude, le ciel était couvert; la pluie allait tomber. Les *Androsace villosa* étaient en fleur; j'avais beau les examiner; je ne trouvais rien. J'allais quitter ce coin lorsqu' un rayon de soleil est venu éclairer la montagne. Alors, sur un jeune bourgeon d'*Androsace*, pliée en arc, j'ai vu une chenille : ce ne pouvait être que celle de *Lycaena pyrenaica*, bien que son signalement ne réponde pas à votre description. Elle devait être dans son dernier stade, et la livrée est différente de celle de jeune âge. Puis, successivement j'en ai pris quatre autres, de diverses tailles, mais toujours sur les fleurs en bourgeon d'*Androsace*. Malheureusement, le soleil s'est voilé, et il a commencé à pleuvoir. Les chenilles ont disparus et j'ai du parter en courant sous une pluie battante, qui n'a cessé que dans la soireé. J'etais mouillé, mais content. Et aussitôt arrivé, j'ai mit mon butin dans une boîte avec une bonne provision de fleur, et je vous ai expédié le tout. . . . J'ai la conviction que, dans un printemps un peu sec, il serait facile, soit à Estaubé, soit a Pouey Aspé, de récolter ces chenilles en nombre.

" L'été va être triste dans notre vallée, la guerre, qui nous prends les hommes, empêchera les étrangers de venir. Et puis, il pleut trop."

Which I roughly and freely translate as follows :—

" *Gèdre*, 14 *June*, 1915.

" An excursion to Pouey Aspé on the 10th proving unsuccessful, I returned yesterday to Estaubé. As usual the sky was overcast, then the rain commenced. The *Androsace villosa* was in flower; I examined them in vain; I found nothing. I was giving it up, when a gleam of sunshine illumined the hillside. Then, on a young bud of *Androsace*, I saw a caterpillar bent in a curve. This could only be that of *Lycaena pyrenaica*, although its appearance does not answer to your description. It was no doubt in its last instar, and its livery is different from that of the earlier stages.

" Then one by one I took four others of varied sizes, but always on the flowers in bud of the *Androsace*. Unfortun-

ately, the sun clouded over and rain began to fall. The caterpillars had vanished, and I had to hurry away under a driving rain, which did not stop till evening. I was wet, but happy. . . . I feel sure that, in a fairly dry spring, it would be easy, either at Estaubé, or at Pouey Aspé, to find a good many larvae.

"The summer will in our valley be a sad one, the war, which has taken away our men, will prevent visitors coming; furthermore, it rains excessively."

June 16th.—Received from M. Rondou five larva of *L. pyrenaica*, four in last instar, nearly full fed, and one apparently in previous instar. They are very like *L. orbitulus*, the green is much darker, the dorsal stripe has paler green on each side, but no white border; the dark oblique marks on the slope hardly exist, and the dorsal hairs are long and all are conspicuously black, otherwise they agree with *orbitulus*, so far as my figures and description of that larva show.

June 17th.—

The small larva supposed to be full-grown in 4th instar (but afterwards found to be only young in the last) is 5·0 mm. long, 1·9 mm. wide, of uniform width, almost equally rounded at each end, the posterior end perhaps a little more pointed. The colour is a dark green, with a brownish-black dorsal line; on mid-slope on 2 and 3 thoracic and 1 to 7 abdominal is an oblique very dark olive-green rather broad line (downwards and backwards), below this the green colour darkens into a brownish and then to pink, just above the whitish pink lateral line; each segment at this line projects as a rounded elevation more markedly than on the dorsal flanges. The hairs are conspicuous and black. The green is appreciably paler just beside the dark dorsal line.

June 17th.—The full-grown larva is 13·0 mm. long and 4·0 mm. wide—a thick-set larva. The black hairs are numerous and conspicuous, the largest about 0·5 mm. long along flanges.

The colour is dark green. The dark brown dorsal line or band is interrupted in the middle of each segment by a patch of pink-red, which hardly extends beyond the lines limiting the band; beside the band is a paler very narrow band of paler green, as of white well-overlaid with green. The dark oblique lines on slope (when younger) are evanescent, one is not sure whether such lines exist or are only shades due to the "upholstered" hollow, of

which there are two: one, the lower, at mid-segment with the black spiracle in its hollow, and the upper one, rather in front of the middle of the segment. The lateral line is pale yellow, with a conspicuous rosy pink patch above it and another below on each segment, sufficiently divided at each incision not to be a continuous line, but looking so on a casual glance. The underside green, but of a slightly olive tint as compared with upper surface, no trace of honey-gland or of fans.

June 17th.—Another specimen agrees, except that the red patches of lateral flanges meet in middle of segment, making the yellow line consist of patches at front and hind margins of segment, and these are so small on 6, 7 and 8 abdominal segments that the yellow line is here practically obliterated. The green ground-colour of this specimen is perhaps rather darker.

Another specimen agrees with first, except that the lateral line is almost white. This one has since last night eaten the central portions of a rosette of the food and the upper surface (leaving the lower cuticle) of several larger leaves.

June 18th.—Placed a larva that was busily eating *A. villosa* on *A. vitaliana*, with a leaf or two of *Soldanella*, last evening. This morning it has not touched either, but placed again on *A. villosa*, it shortly commenced eating, and continued eating all day as if to make up for lost time.

June 19th.—One has died with the hard black patches disorder. This is the larva with skin structures shown in Pl. LXXVI and LXXVII so curiously demonstrated.

June 22nd.—The three full-grown ones seem to have settled down for pupation, look bunched, and are quiescent. The small one seems really to be in last skin, as it has not moulted, is eating well and growing; its darker colour was no doubt due to inexpansion of skin after recent moult. It eats especially the fruit-pods, *i. e.* the calyx contents of the now dead flowers.

June 23rd.—One of the full-grown larvae appears to be parasitised; it has much the form of a larva waiting for pupation. Yesterday the tracheae were very visible, to-day they are not, and the whole larva is darker, and feels very firm and resistant, suggesting a dipterous pupa within.

Material being scarce, it seemed desirable to secure the larval skin whilst it seemed perhaps possible to remove it from the parasite. This being done, it was found that the

parasite was an ichneumon forming a silken cocoon. The skin is not very satisfactory, certain layers of silk remaining adherent to it, nor did it seem to be prudent to attempt their removal.

June 25th.—One of the remaining full-grown larvae is found this morning to have pupated; the other is ichneumonised like the one noted on the 23rd. It had the tracheae very visible. On opening it, the skin is lined with silk by the ichneumon, but the larva of the parasite is removed without any silken covering, the inner cocoon proper not having been commenced. It may be noted that the larval skin contains nothing but the tracheae, a silken lining, and the larva of the parasite; no other remains of the host's interior than the tracheae, no trace of any dejecta of the larva of the parasite.

The small larva has grown and eats the ovary (immature seed-pods) of the recently faded flowers, the larger larvae seemed to prefer the leaves.

June 26th.—The pupa, which was very dark when seen yesterday, is perhaps rather darker to-day.

The abdomen is of a very deep ochreous brown with a darker, nearly black, dorsal band. The thorax, head and appendages are very dark, almost black. The whole pupa is very polished and shining. It has (except on appendages) a great many very short pale brown hairs, most easily seen in profile on abdomen, where they appear to be very abundant. The pupa is short and thick, length 9 mm., height thorax 3·5 mm., waist 3·1 mm., abdomen (3rd and 4th segments) 4·0 mm., abdominal line (beyond wings) 2·2 mm. Opposite 3rd and 4th abdominals the wings project a little ventrally, but otherwise the variations in height are due to dorsal curves. The width to waist is 3·3 mm. expanding at 4th abdominal to 3·7 mm.

The general outline is normal Lycaenid.

June 29th.—Yesterday and to-day the small larva is eating leaves of the centre of rosettes, leaving one cuticle of the larger leaves; the seed-pods are possibly getting too ripe and hard to suit him.

June 30th.—The cuticle left is indifferently the upper or lower of the leaf. Of two rosettes given to the larva yesterday, both having a good many leaves eaten, one shows the lower cuticle to be left in each leaf eaten, the other the upper cuticle; this can apparently only depend on the direction in which the larva approached the rosette, but

even so it is curious that each rosette shows the same direction of attack on every leaf.

July 4th.—The larva has been eating pods as well as leaves, so that there is probably no ground to suppose the former to be too hard for it; the seeds seem to be the portions eaten, portions of empty capsule remaining.

July 5th.—Has taken to resting, as if it had done feeding.

July 7th.—Resting on bottom of glass, without apparently any special selection; seems to contemplate pupating, as it is very bunched and thoracic segments enlarged.

July 8th.—To-day the larva is dark coloured, of very uniform short thick cylindrical shape, and is evidently the victim of the ichneumon to which the two others had succumbed. The parasite is now no doubt spinning its cocoon inside the larval skin.

July 11th.—The pupa is apparently beginning to mature; the wings, instead of being nearly black, but with a transparent look, are now a deep rich brown, with the veins somewhat darker, and the rest of the pupa is not quite so dark, but the eyes are black.

July 14th.—Gradually got darker and then paler over the abdomen. This morning white lines marked the opened incision of abdominal segment 3 to 4 slight, 4 to 5 and 5 to 6 very definite white rings for whole circumference, 7 to 8, faint dorsal lines. The butterfly, a ♀, emerged at 9 a.m.

July 26th.—A parasite emerged to-day.

July 30th.—Mr. Morley names the specimen *Meloboris crassicornis*, Grav., an Ophionid ichneumon.

On Pl. LXVI are enlarged drawings of the larva skins (figs. 1 and 2) (see Trans. Ent. Soc. 1914, p. 479) of *P. eros* which produced *Rhogas bicolor*, and (figs. 3 and 4) the skin of *L. pyrenaica* which produced *Meloboris crassicornis*.

Of the five larvae sent by M. Rondou, one died and three were parasitised, all apparently by the same parasite, *Meloboris crassicornis* (see Morley's "Ichneumonidae," vol. v, p. 172). Mr. Morley says (in letter) "he considers it by no means impossible that, in your case, it was hyperparasitic through a *Rhogas*." The two first examples to declare themselves parasitised were killed for the sake of the larval skins, of which I had only that of the one that died, and that of course a poor specimen. The parasitised ones had the outer part of the cocoon of the parasite already spun inside, so that they also were not

very satisfactory examples of the larval skin. In the case of the first one, whose condition was not recognised till rather late, the cocoon of the parasite was so far advanced as to show the zonal dark colouring described by Morley (*l. c.*). The one that emerged (No. 3) did so by gnawing a hole in much the same way as the *Rhogas* did in the case of *eros*, but instead of being at the posterior end of the butterfly larva it is in front, quite to one side of the middle line. In *eros* the dead larva is attached by the head, in *pyrenaica* by the claspers.

Though I did not desire to rear *L. pyrenaica* with the object of strengthening its claim to be distinct from *L. orbitulus*, since I considered that to be already abundantly established, I was much interested to discover the points in which they differed in their early stages, and in simple fact found many items showing how distinct the two species are. I have described the very great differences in the two eggs, and in the first-stage larvae; they are, as I have above described, so different that, considering the trifling points that distinguish many of the species of the *Polyommatus-Agriades* group at this stage, one would, with only these first-stage larvae before us, say that they probably belonged to two quite distinct genera. The larva in the autumn in 2nd and 3rd instars is extremely dark and very different from that of *orbitulus* at this stage. The young larva of *orbitulus* has much of the bright colouring of the full-grown larva. This great divergence between the two species—in the egg and in the structure and colour of the young larva—is very remarkable, in view of the great similarity of the full-grown larva, of the pupa and the imago.

The colouring of the full-grown larvae is very close, but certain areas in *orbitulus* are quite white, which are only slightly paler than the ground-colour in *pyrenaica*. Both larvae are without honey-gland, and both feed on primulaceous plants, though *pyrenaica* will starve rather than eat those species affected by *orbitulus*.

Though the pupae are otherwise so much alike it is remarkable that *L. orbitulus* has abundant anchor-ended hooks of normal type over the cremastral area, whereas *L. pyrenaica* is without hooks of any sort.

Explanation of Plates LXV–LXXXII.

Plate LXV. Figs. 1 and 2. Larva in 3rd instar before hibernation, enlarged about × 10.
Fig. 3. Rosette of *Androsace villosa* × 2.
Fig. 4. Rosette of *Androsace villosa* central leaves mined by *L. pyrenaica*.
Fig. 5. Rosette, some leaves mined and central bud undermined and lost; it is not eaten but dries up and easily falls off.
Figs. 6, 7, 8. Larva in last instar, enlarged about × 5.

Plate LXVI. Figs. 1 and 2. Larva of *Polyomnatus eros*, from which *Rhogas bicolor* has emerged (see Trans., 1914, p. 479) × 4.
Figs. 3 and 4. Larva of *L. pyrenaica* from which *Meloboris crassicornis* emerged × 4.

Plate LXVII. Eggshells of *L. pyrenaica* × 60.

Plate LXVIII. Fig. 1. Egg of *L. pyrenaica* × 60.
Fig. 2. Micropyle × 350.

Plate LXIX. Stereoscopic view of two rosettes of *Androsace villosa* with eggs of *L. pyrenaica* as laid × about 5.

Plate LXX. First-stage larva skin × 60.

Plate LXXI. First-stage larva skin × 60.

Plate LXXII. Second instar larva skin × 36. N.B. the clear space on the 2nd abdominal segment is abnormal.

Plate LXXIII. Second instar. Prothoracic plate × 200, and last abdominal segments × 100.

Plate LXXIV. Last-stage larva skin × 9.

Plate LXXV. Last-stage larva prothoracic plate × 100. Dorsum of 7th and 8th abdominal segments × 50. The dark shades across at top and at middle of photograph mark the segmental incision; the position occupied by honey-gland in species possessing it is just above the lower of these. There is no indication of it.

Plate LXXVI. Fig. 1. Honey-gland region of another specimen; the position, did one exist, would be centrally between the two upper spiracles (those of 7th abdominal segment).
Fig. 2. A dorsal hair × 100.

The lower figure (3) shows a curious structure apparently belonging to the skin, which was seen as photographed in the incisions in front of the first seven abdominal segments, in the line of the lateral flange, in a larva of *L. pyrenaica* which died of some malady. It seems to be a normal structure of Lycaenid larvae, as it can be faintly discerned in some examples of other species; the peculiarity here is its being rendered so conspicuous in this diseased specimen. Some stain might probably demonstrate it in normal individuals × 100.

PLATE LXXVII. Shows two other specimens of the same structures.

PLATE LXXVIII. FIG. 1. Pupal skin × 6½.
FIG. 2. Pupal skin. Dorsal head-piece, prothorax, greater part of mesothorax with cover of its spiracle, and an angle of metathorax × 30. In fig. 1 the dorsal head-piece is lost on one side.

PLATE LXXIX. Pupal skin.
FIG. 1. Head and portions of appendages × 20.
FIG. 2. Appendages as in lower portion of fig. 1 × 50, showing lenticles on legs but not on antennae or maxillae.

PLATE LXXX. Pupal skin.
FIG. 1. Right metathorax, with adjacent portion of mesothorax and wing × 30.
FIG. 2. A portion of wing, shows lines of neuration and Poulton's line × 30.

PLATE LXXXI. Upper figure shows ventral aspect of abdominal segments (5th abdominal with 6th, 7th, etc.) × 50.

Lower figure, which overlaps upper, shows cremastral area (9th and 10th abdominal segments); there are ordinary hairs but no hooks; the specimen is a ♀ × 50. Compare with Plate XXVII, Trans. 1911, which shows *orbitulus* to have abundant anchor hooks.

PLATE LXXXII. Pupal skin. Upper figure shows dorsum of 2nd and 3rd abdominal segments × 50.

Lower figure, spiracular region of 4th abdominal segment × 100.

XXI. *A Contribution to the Life History of* Agriades escheri, *Hb.* By T. A. Chapman, M.D.

[Read October 6th, 1915.]

Plates LXXXIII–CIII.

My interest in *Agriades escheri* arises from the investigations about *Agriades thersites*, since it appeared that *thersites* was, notwithstanding its close resemblance to *P. icarus*, not at all nearly related to that species, but was in many respects so similar to *A. escheri* as to suggest that *escheri* and *thersites* were quite recent derivations of a form very close to *escheri*.

There seemed, however, to be no published life-history of *A. escheri*, nor, so far as I have been able to learn, any figure of the larva, though its food-plant is referred to by several authorities, the original information apparently being from Saporta for *Astragalus incanus*, and Donzel for *Astragalus monspessulanus*, though I have not found where they published these facts. It curiously happens that in the Bulletin of the Entomological Society of France (1915, No. 8) there is reported "Notes on Lycaenid larvae by Monsieur P. Chrétien," read 28th April, 1915, amongst which is a fuller account of the life-history, running to a page of the Bulletin, than had previously appeared anywhere.

He also has notes on *L. orbitulus* and *L. eros* whose larvae he appears to have known for some time.

It appeared desirable, therefore, to learn something of the life-history of *A. escheri*. I failed, however, in 1913 to obtain any ova, and so the observations had to be postponed to 1914.

On the 28th April, as noted in Trans. Ent. Soc., 1914, p. 482, I visited the locality on the way to Berisal, where *Astragalus exscapus* grows freely, in order to find the larva of *A. escheri*, since the butterfly is not uncommon there, and this *Astragalus* seems to be the only probable food that grows in the locality. I found two larvae that I took to be *escheri*, but, as I failed to rear either, could not be sure, until this year I reared the larva from the egg, and so satisfied myself that the Berisal larvae were the same as those that were, of course, certainly *A. escheri*.

These larvae are figured on Plate LXXXIV, figs. 12, 13 and 14, and may be compared with the 1915 larvae on Plate LXXXV. They hardly differ by even the individual variation which is common in the larvae of "Blues," but is perhaps less in *A. escheri* than in many other species. The note made on April 27th, 1914, was that they were "rather dark green, darker in the dorsal trough, with a narrow yellow line down dorsal and lateral flanges, there are two pale oblique lines between dorsal flange and spiracles. The honey-gland and position of fans distinct, hair bases black, as well as many hairs. But most of the hairs on the lateral flange are white, as well as some on the dorsal flange, chiefly those forming a dorsal crest to each segment, those a little below them being dark." On April 1st: "The larva is remarkable for the very narrow but definite yellow lines, and for the distinctness of the oblique lines that look as if resulting from a thin overlaying layer of white pigment."

"There are really three whitish oblique marks on the slope of each segment: a middle one, fairly well pronounced, an upper one on the side of the projection of the dorsal flange, and a lower one in which is the spiracle; the upper and lower are rather patches, and are oblique only on their margins apposed to the middle of the three. In most views of the larva, only two of these marks are obvious, the upper or lower being evasive."

On the 7th April: "It is of a more uniform green, the pale oblique lines are less distinct and the yellow lines less vivid, the hair bases are conspicuously black, but the long hairs of dorsal and lateral flanges are colourless, except a few black ones on last segments."

Owing to ill-usage due to travelling, though both larvae pupated, the pupae were not healthy and neither progressed further.

It may be observed that in describing three pale oblique lines, one neglects the alternative of describing two darker lines, viz. the two areas between the paler ones; the difference arises from choosing to regard the paler or darker areas as the ground-colour.

These larvae eat into the central growing buds in the heart of the mass of foliage forming the plant of *Astragalus exscapus*, its habits in this respect being practically identical with those of *P. lycidas* on the same plant. Mr. Main's photograph, Plate LXXXVIII, fig. 25, shows this very

well, but the larva goes deeper than shown, practically out of sight, a circumstance that a photograph could not, of course, demonstrate.

At the end of July 1914, being at Gavarnie, I succeeded in obtaining eggs of *A. escheri* var. *rondoui*. This egg is small, 0·6 mm. across, and 0·22 mm. high. It is remarkable as having a very flat level top, and very perpendicular sides, not curving in an appreciable degree either towards the top surface or the base. The top is quite free from knobs at the intersections of the network except at the absolute margin, thence down the sides the knobs (or pillars) are well developed. A comparison with the eggs of *thersites* and *icarus* (Trans. 1914, Pl. XXXV) shows that in the flat smooth top and perpendicular sides it differs much from both these, and, if anything, *icarus* resembles it rather more than *thersites* does. The egg is photographed, Pl. LXXXVII, fig. 23.

The eggs very obligingly did not hatch until just as I reached home after the prolonged journey from Gavarnie, but began doing so immediately on my arrival (Aug. 9th).

When newly hatched the larva is very pale yellowish green, almost colourless; the dorsal hairs are very long, forming a high double crest; the lateral hairs are also very long and conspicuous. As it matures, it acquires a darker dorsal line or band, and a similar dark band a little way above the spiracles.

In comparing the panoply of hairs, lenticles, etc., there is little to distinguish the larvae of *escheri*, *thersites* and *icarus* from each other; *escheri* and *thersites* have the long hairs distinctly longer than in *icarus*—the former about 0·28 mm. against 0·21 mm. in *icarus*. The angular hairs on the prothoracic plate are very close to the posterior hairs in *escheri*, a little less close in *icarus*, and quite away towards the angle in *thersites*. I have not seized any other differences with certainty, but there are probably others. Two specimens showing the hairs, etc., are photographed, Pls. LXXXIX, XC, figs. 26 and 27.

On Aug. 18th some of the larvae were undergoing their first moult, and practically all had completed it on Aug. 21st. At this date they were 2·2 mm. to 2·5 mm. long, pale translucent green, with darker dorsal line (vessel) and a dark shade along middle of slope. The flange hairs are long, but not proportionally so long as in 1st instar, the dorsal ones form a crest, and the lateral ones rest on the leaf surface

like those in some Lasiocamps or say, more vulgarly, like a cowcatcher. As they get older (Aug. 24th), a few develop dorsal and lateral yellow flange lines (as in *Coridon*, etc.).

The armature of hairs, etc., in the 2nd instar is shown in Pl. XCI, fig. 28.

On Aug. 27th several are in 3rd instar, and these vary much in colouring, or rather perhaps in marking; some have paler, hardly yellow, dorsal and lateral flange lines; most have some indication of a darker, greyish longitudinal band along the middle of the slope—one or two have this very marked; the hair bases are black, and a good many hairs are black, so as to be quite obvious.

On Sept. 9th they seem now to be full-grown or nearly so in 3rd instar, and some have ceased feeding.

They are 4·5 to 5·8 mm. long, green, with a paler hardly yellow lateral flange line, a darker medio-dorsal line, and a similar darker (dark apple almost olive green) line half-way up the slope; on each segment this has above and below it a paler line or streak, the three together just visibly oblique (downwards or backwards) when closely observed. There is a rather darker shade just above the lateral line. Seen laterally the dorsal humps on each segment are marked; on each are several, 3 or 4, long dark hairs (about 0·3 to 0·5 mm. long). The lateral hairs are pale brown.

In one larva the lateral line and one down each dorsal flange may be called yellow, and the darker shades can only be recognised as having a slightly different tone from the ground-colour. Another larva is rather darker, so that the lower portion of the slope is dark. Most show a dark mark near the spiracle.

Sept. 16th.—All seem to have laid up for the winter, most on the leaflets of the food-plant, much as they do when at rest, but still feeding; others on the bottom of the box. Their colours vary from a nearly uniform green, with just a suspicion of paler (yellowish) dorsal and lateral flange lines, and still fainter oblique lines; others are very dark with dark shading over large areas. The drawings by Mr. Knight are excellent; they perhaps hardly show the oblique lines to be quite as oblique as they are. Really the obliquity is very faint, and only shows at each end of the paler shades above and below the dark line, which is nearly straight.

Several varieties of the larva in 3rd instar are shown in Mr. Knight's drawings, Pl. LXXXIII, figs. 1, 2, 3 and 4.

The larvae were placed in a refrigerator during the winter

at a temperature of about 34° to 39°. Observing these and other larvae during the past winter, I have arrived at the opinion that the mortality amongst hibernating Lycaenid larvae under my care, or want of care, has been chiefly due to letting them get too dry. When made sufficiently damp afterwards they become mouldy, and one concludes they died from being too damp, and so one's procedure is corrected in the wrong direction. The correct way is to look them over carefully every two or three weeks and see that they are just right. The disturbance may not be good for them, but it is a much less evil than their getting either too damp, or, in an effort to avoid this, too dry.

On Feb. 8th, 1915, I brought thirteen larvae into a warm room; not till the 24th did they begin to eat, when one small mine was seen in a leaf of *Astragalus*. Of these thirteen larva ten were put on a growing plant on Feb. 28th.

On March 9th, of the three kept in tins, two are eating a little of a young *Astragalus* leaf.

March 13th.—One (No. 1) of the three has moulted this morning (into 4th instar) without having grown at all or eaten more than a very trifling meal.

March 18th.—No. 2 moulted this morning. No. 1 is eating but very moderately.

March 20th.—The larvae in 4th instar are in several instances, as noted two days ago, green, with dorsal and lateral stripes almost yellowish; but one at least is quite dark, of much the aspect of the darkest of those in 3rd (hibernating) instar.

No. 1, 7 mm. long, green, with narrow yellow lateral line, dorsal lines (flanges) a little paler but not yellow, has oblique dark band on each segment, half-way up slope, bordered above and below by paler green; medio-dorsal line is also rather dark, dorsal outline (seen laterally) a little serrated, each segment rather higher at its posterior than anterior margin.

No. 2 is a darker larva, so that the dorsal flange lines seem to be yellowish, and the oblique lateral lines are reinforced by (1) a slight depression at posterior margin of each segment of the dorsal flange lines, (2) and (3) the yellowish lines above and below darker central slope line, (4) a yellowish patch, slightly oblique near spiracles; the yellow lateral line is not at all oblique.

March 30th.—No. 3 has moulted for third time.

March 31st.—The larvae in 4th instar, so far as may be

gathered from the three specimens, get greener as they grow, very decidedly more than mere spreading of the dark hair bases would cause, probably due to ingestion of fresh food.

April 4th.—No. 3 looks dark and small and has not yet begun feeding after moult. No. 2 still feeding, length 7·3 mm. No. 1, apparently laid up for moult (4th and last), is barely 7 mm. long, but thickened up to 2 mm., fairly uniform in width to 6th abdominal segment, width and height nearly equal, tapers a little after 6th. Colour unchanged, yellow lateral line, pale dorsal flange lines, and oblique lines chiefly marked by the darker shade between them at mid-slope; this shade is divided on each segment into an anterior and a posterior patch.

On entering 4th instar, No. 3 as an example is 4·3 mm. long, of a warm (or reddish) grey, not at all green, with lighter dorsal flange line and mid-slope line, and a narrower and rather oblique one between these. In the wide interspace between mid-slope and lateral (hardly yellow) lines is only a central small pale shade, the rest ground-colour. It very much, in fact, resembles the third-stage larva, but as it grows takes on quite a green coloration. These several aspects are shown on Pl. LXXXIII, figs. 5, 6, 7. The figures might give the impression that the larva is as green in the 3rd as in the 4th instar; it may be in some instances, but as a rule the larvae are generally without much green in 3rd instar, and all are green when well grown in the 4th. The skin structures are shown on Pl. XCIII, with some details on Pl. XCIV.

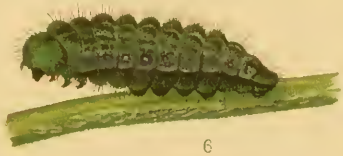
April 9th.—No. 1 has moulted into 5th (last) instar this morning; it is now an especially green larva, the yellow lateral line is really yellow, but is the only portion (head and legs, of course, excepted) that is not merely some shade or variant of green. The dorsal ridges (flanges) are a paler yellowish green, the dorsal trough darker. The slopes show (on each segment) the darker oblique band between the paler (yellowish) lines, and the spiracles are marked as whitey yellow dots. The fans, or rather their sites, are also seen as conspicuous whitish spots. Some of the dorsal hairs are dark, but the majority nearly colourless; the bases are dark, but have little effect on the general tone of colour. On touching the 5th and 6th abdominal segments, the fans were everted and the head and front segments raised, showing irritation rather than any pleased response as to ants.

April 14th.—No. 2 moulted into last instar.

1

5.

2.



6

3

7.

8.

4

E.C. Knight del

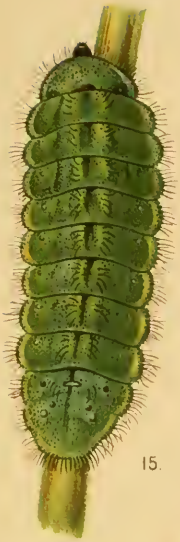
Millard and West, Newman chr.

A. ESCHERI, LARVÆ IN 3rd & 4th INSTARS.

E. C. Knight, del. et pinx.

Adlard & Son and West Newman.

LARVAE OF AGRIADES ESCHERI.



15.

18.

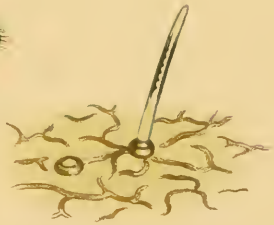
x 5

19.

17.

16.

20. *nat. size.* *x 3*



21

E. C. Knight del.
F. W. Frohawk ,,

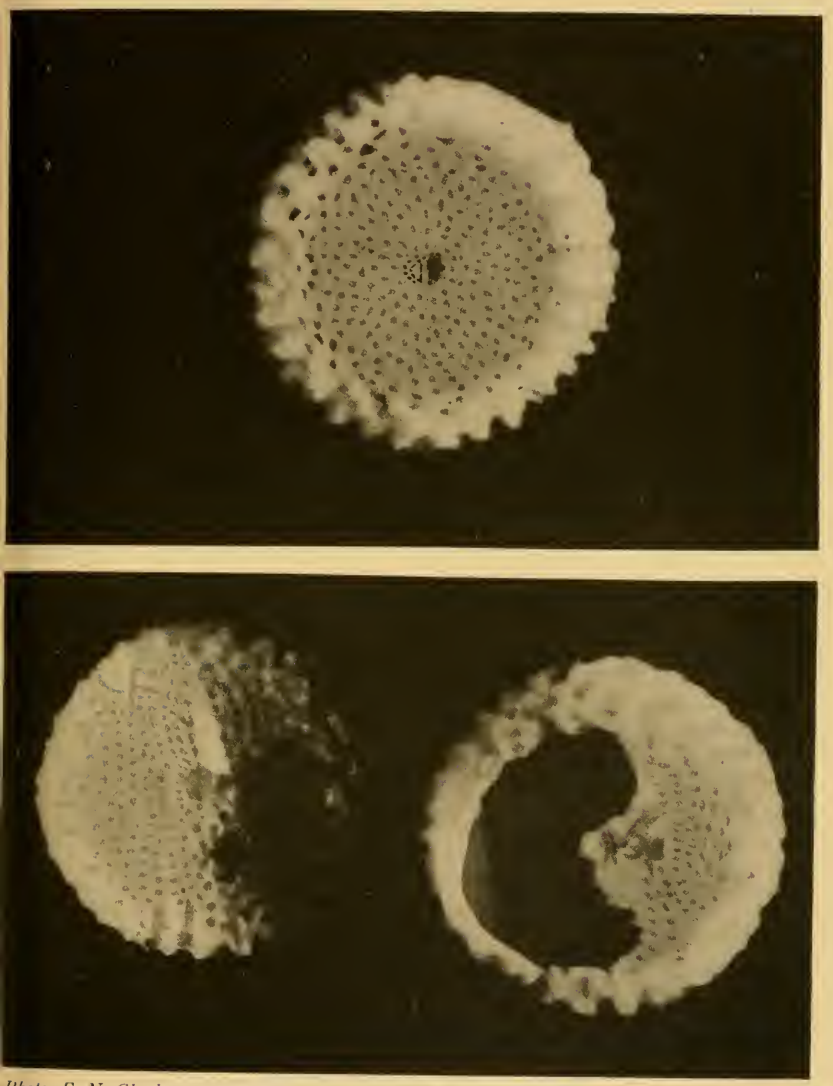
Adlard and
West, Newman chr.

A. ESCHERI, LARVA IN 5th (LAST) INSTAR.

Photo, A. E. Tonge. *Anglo-Engraving Co., Ltd.*

FIG. 22.

A. ESCHERI, ASTRAGALUS MONSPESSULANUS LEAVES EATEN BY YOUNG LARVAE.



Photo, F. N. Clark. *Anglo-Engraving Co., Ltd.*

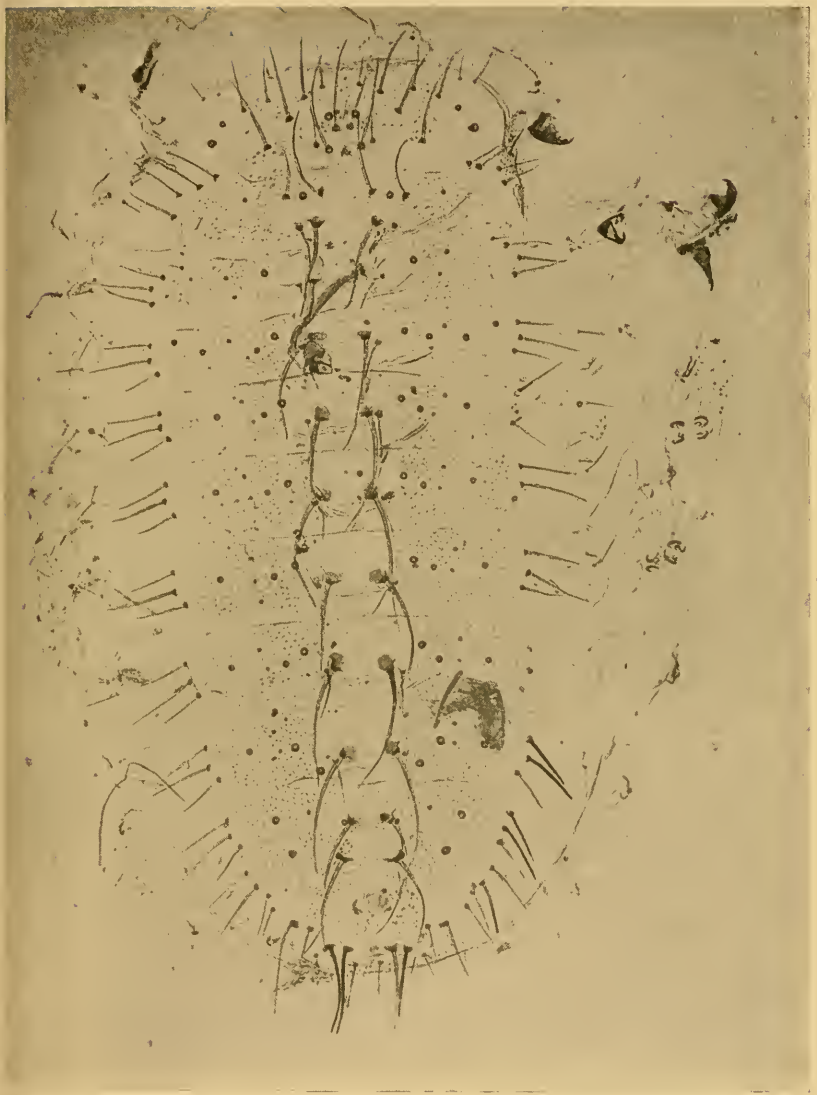
FIG. 23.

A. ESCHERI, EGG AND EGGSHELLS × 80.

Photo, F. N. Clark and H. Main. *Anglo-Engraving Co., Ltd.*

FIGS. 24, 25.

A. ESCHERI, MICROPYLE × 350. LARVA IN ASTRAGALUS EXSCAPUS.



Photo, F. N. Clark. *Anglo-Engraving Co., Ltd.*

FIG. 26.

A. ESCHERI, SKIN OF LARVA IN FIRST INSTAR × 60.

Photo, F. N. Clark. *Anglo-Engraving Co., Ltd.*

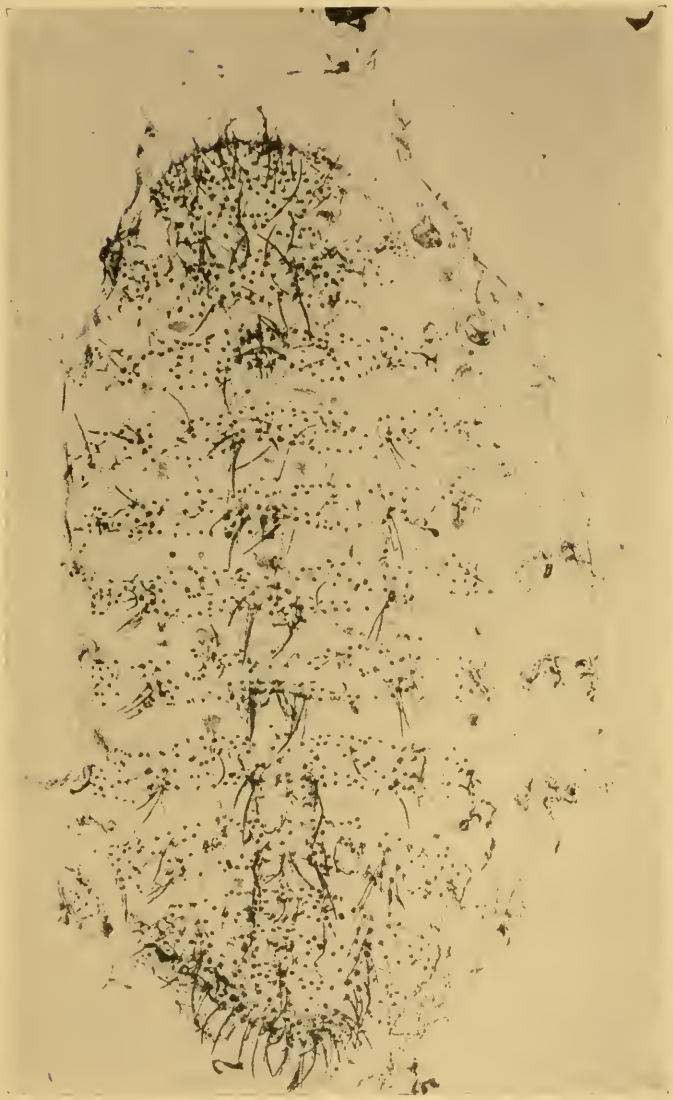
FIG. 27.

A. ESCHERI, FIRST STAGE LARVAL SKIN × 60.

Photo, A. E. Tonge. *Anglo-Engraving Co., Ltd.*

FIG. 28.

A. ESCHERI, SKIN OF LARVA IN SECOND INSTAR × 29.



Photo, A. E. Tonge. *Anglo-Engraving Co., Ltd.*

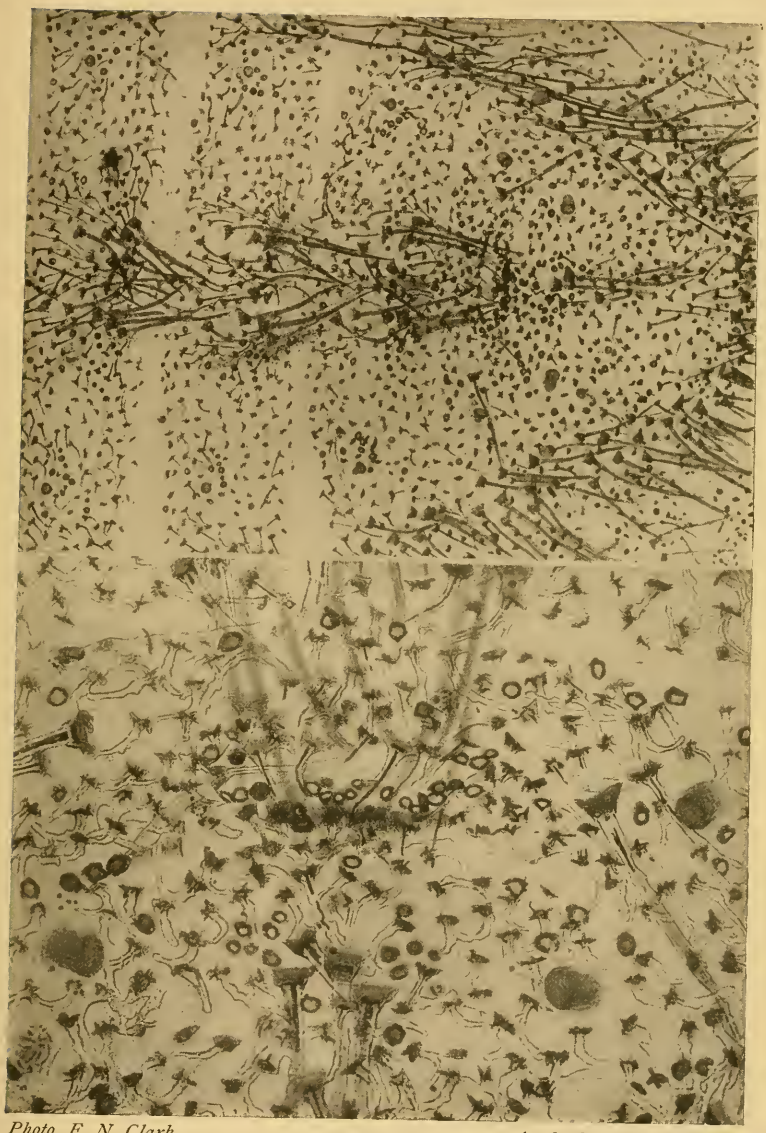
FIG. 29.

A. ESCHERI, SKIN OF THIRD STAGE LARVA × 22.

Photo, F. N. Clark. *Anglo-Engraving Co., Ltd.*

FIG. 30.

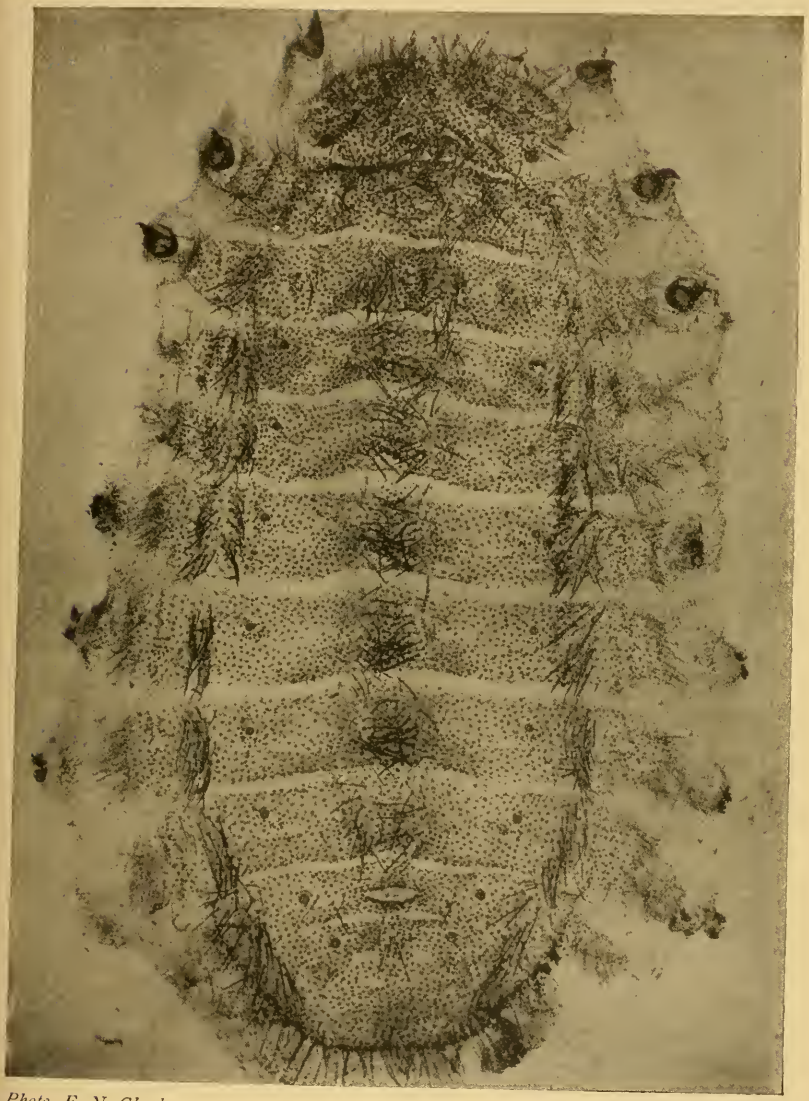
A. ESCHERI, SKIN OF LARVA IN FOURTH INSTAR × 20.



Photo, F. N. Clark. *Anglo-Engraving Co., Ltd.*

FIGS. 31, 32.

A. ESCHERI, HONEY GLAND REGION IN FOURTH INSTAR × 35 and × 100.



Photo, F. N. Clark. *Anglo-Engraving Co., Ltd.*

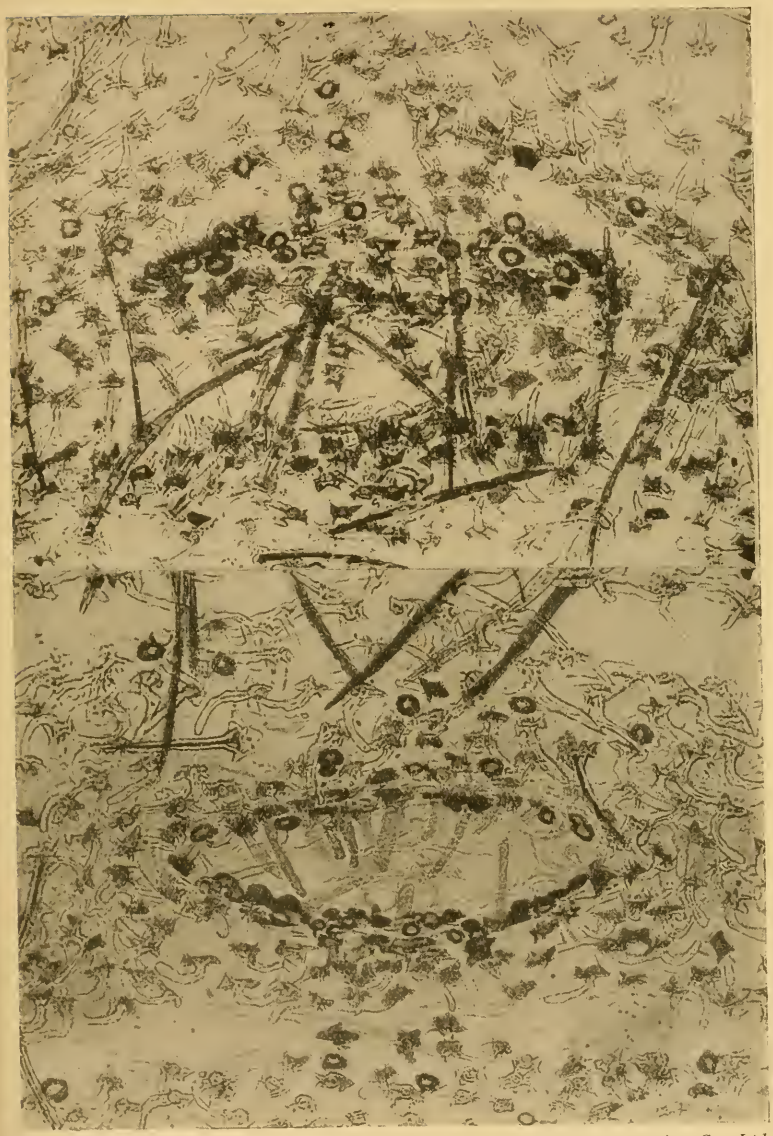
FIG. 33.

A. ESCHERI, SKIN OF LARVA IN LAST INSTAR × 14.

Photo, F. N. Clark. *Anglo-Engraving Co., Ltd.*

FIGS. 34, 35.

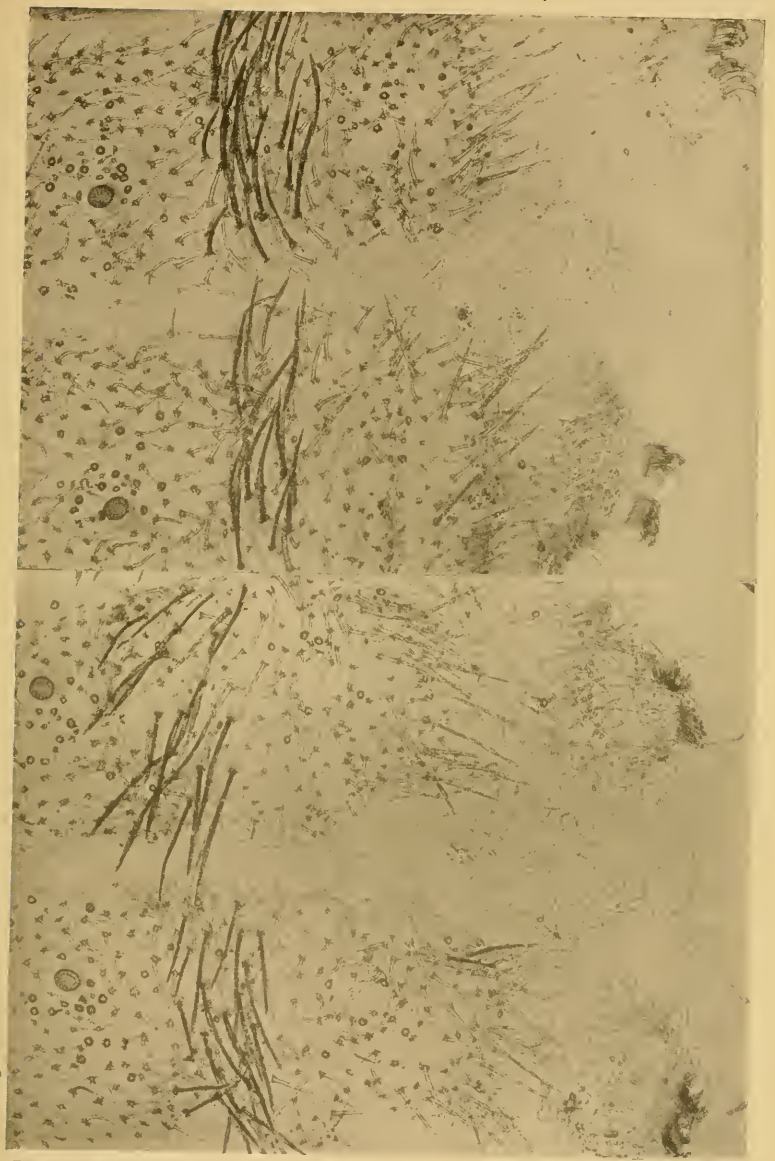
A. ESCHERI, LAST LARVAL INSTAR, PROTHORAX AND HONEY GLAND × 35.



Photo, F. N. Clark. *Anglo-Engraving Co., Ltd.*

FIGS. 36, 37.

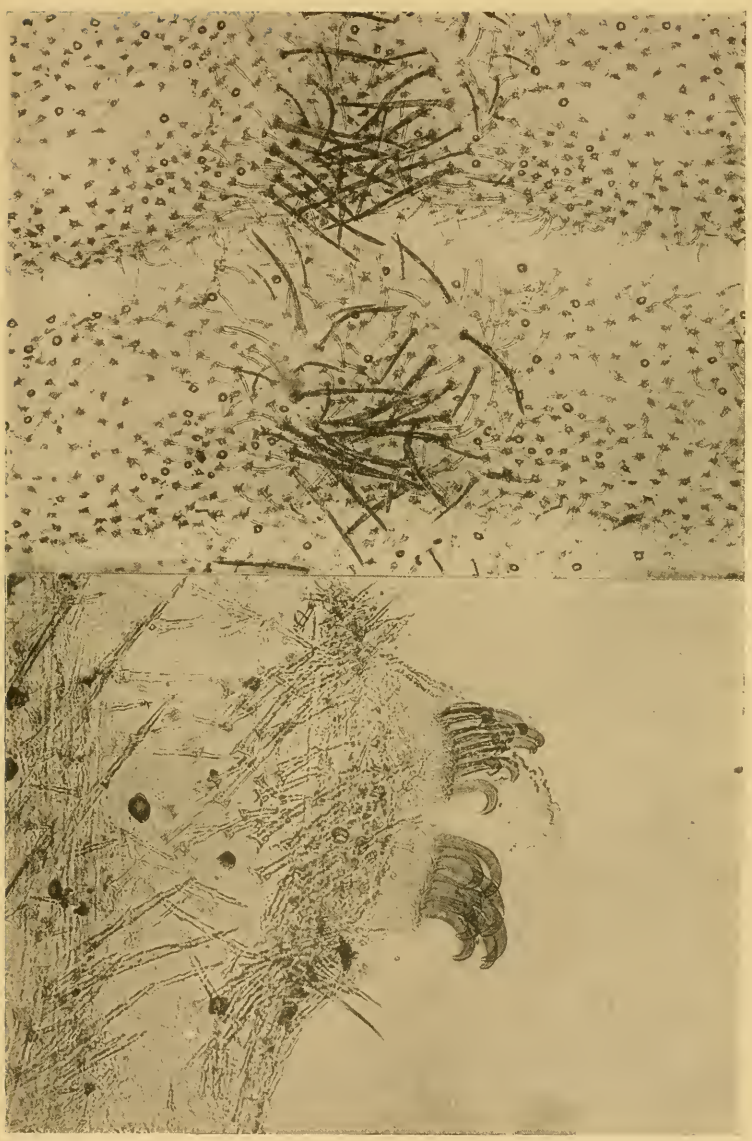
A. ESCHERI, LAST LARVAL INSTAR, PROTHORACIC PLATE AND HONEY GLAND × 100.



Photo, F. N. Clark. *Anglo-Engraving Co., Ltd.*

FIGS. 38, 39.

A. ESCHERI, LAST INSTAR, MARGINS OF ABDOMINAL SEGMENTS × 40.



Photo, F. N. Clark. *Anglo-Engraving Co., Ltd.*

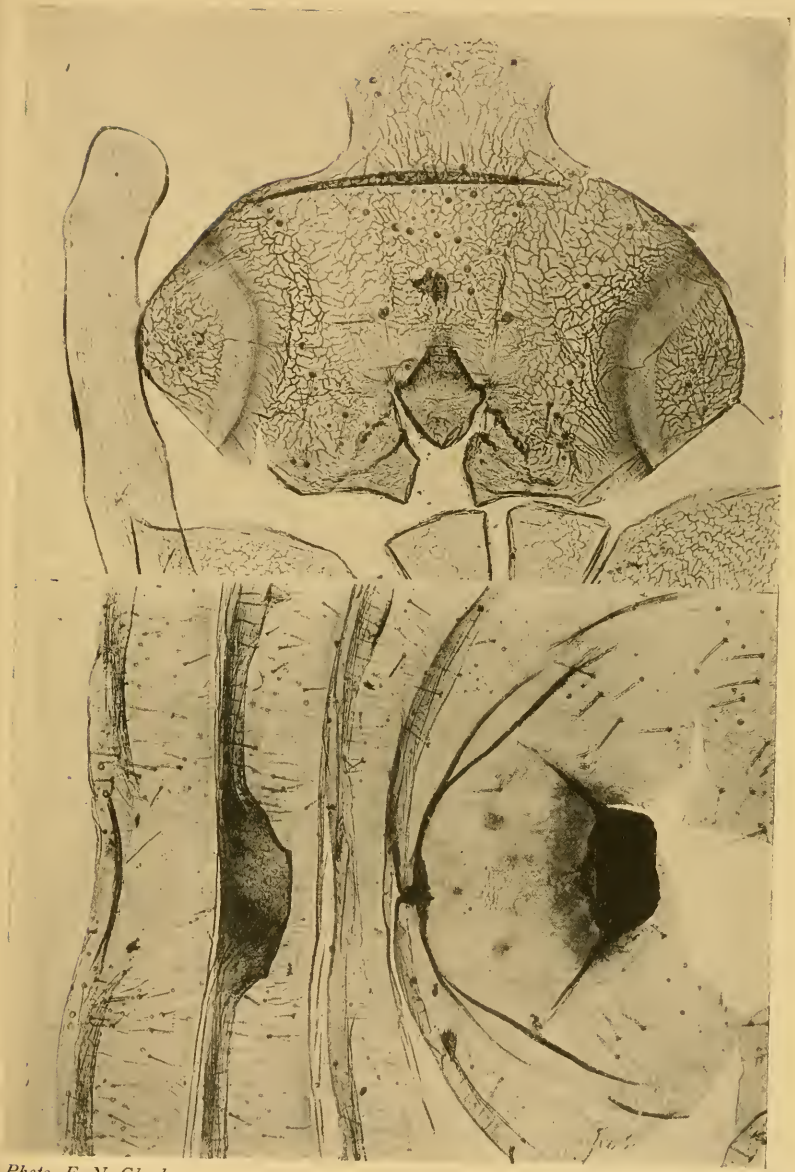
FIG. 40.—Dorsal region of larva in last instar × 40.
FIG. 41.—Proleg of larva in last instar × 100.

A. ESCHERI.

Photo, H. Main. *Anglo-Engraving Co., Ltd.*

FIG. 42

A. ESCHERI, PUPA. STEREOSCOPIC.



Photo, F. N. Clark. *Anglo-Engraving Co., Ltd.*

FIGS. 43, 44.

A. ESCHERI, PUPA, HEAD, ABDOMEN AND CREMASTRAL AREA × 30.

Photo, F. N. Clark. *Anglo-Engraving Co., Ltd.*

FIG. 45.—Prothorax, etc. × 30. FIG. 46.—Metathorax, etc. × 30.

A. ESCHERI, PUPAL SKIN.

Photo, F. N. Clark. *Anglo-Engraving Co., Ltd.*

FIG. 47.

A. ESCHERI, PUPA, THIRD ABDOMINAL SPIRACLE × 40.

April 22nd.—I have now three larvae nearly full-fed, viz. "No. 1," and two (of ten) on growing plant.

They are about 14 to 15 mm. long (about 10 mm. when contracted after disturbance). They are green with a more or less bright yellow lateral line, a faint dorsal one very visible on direct dorsal view, but not seen on view 45° from this. The mid-slope darker stripe is just seen, and seems to have fewer and shorter hairs on its front portion on each segment than elsewhere. The paler oblique line above it and two below it are plain, but almost need looking for.

The longer hairs all over the dorsal flanges are dark, but hardly black, those on the lateral flanges are pale rufous. The very short hairs on the slope appear to be colourless, and it depends on the incidence of light and angle at which viewed, whether the silvery hairs or their dark bases are seen; sometimes, for example, the upper half of slope is silvery, the lower half presents black points (under a lens, of course), or, again, *vice versâ*, the difference between the upper and lower portions is probably due to the slope being rounded and not plane, and not to any difference in the setting of the hairs, etc.

The fan point is often very distinct as a white dot, the spiracles much less so as orange points.

The hairs at mid-slope are a little longer than the others. The honey-gland is rather small and inconspicuous.

The diamond-shaped prothoracic plate is small, less clothed with hairs than the skin about, and has a rather shiny slaty look.

The true legs are green to faintly ochreous, only tinted a pale chitinous brown towards their tips.

The head is very difficult to see, as it is on disturbance buried deeply in the prothorax, at other times such portion, really a very small one, that protrudes is hidden between the prothorax and the food. In repose the head and true legs are sunk in a groove formed under the thoracic segments.

The larva is, of course, of ordinary Plebeiid form, the dorsal flanges are only a little less separate in front than behind, each segment is dorsally rather higher at posterior than anterior margin, *i. e.* in 1st to 6th abdominal segments. The mesothorax overhangs the prothorax in the usual way.

The history of the ten larvae placed on a growing plant on Feb. 28th is chiefly of interest, or was to me, as illustrating the facility with which the larva could hide itself on a plant growing in a flower-pot, and not therefore of large

size. The plant was cooler at night, but often much warmer by day, when the sun shone, than those I kept in tins. Sometimes the thermometer went up to 90° not directly exposed to the sun.

On March 18th it is noted: "One or two (in 4th instar) are now and then seen; one this morning on a petiole is pale green with paler (hardly yellow) dorsal (double) and lateral stripes. They appear to eat, but only very little, between waking up from hibernation and making their third moult."

March 20th.—Of the ten larvae on growing plant one or two are now and then seen, but they hide very completely. The plant is growing vigorously, and has some flower-heads on stems several inches long, down to others that are merely little rough ridges on the growing centre; many of these in size and appearance closely mimic the young larvae of *escheri*. I say that the plant mimics the larva, to call attention once more to the fact that unconsciously this view of the matter presents itself to the mind when one is searching for the larvae, although one does not for a moment really think so, but knows it is the larva that mimics the plant. In the search, the larva is the rarer, and one probably often misses the larva altogether; but when one sees it, one is satisfied and there an end; but the mimicked portion or aspect of the plant often needs a second glance to make sure it is not a larva, and so for the purposes of our search it is the plant and not the larva that appears to deceive us, and so seems to be the active member of the partnership.

April 22nd.—The ten larvae have never shown more than one or two at a time, even with the closest search possible, without pulling the plant about. I determined a week ago to remove these ten larvae into glasses, thinking it possible that there might be some Carab, or other depredator present that had reduced the ten to two or three, and so to save the remainder. First day secured two, the next day one, again one, on 20th two, this morning one, making altogether seven out of the ten; the remaining three may have perished, but probably not all of them. Securing seven shows how efficiently they hide on the plant. Two of them are nearly full-fed, one is laid up for fourth moult, the other apparently small in last instar.

April 24th.—Found a larva (No. 8) this afternoon; it was high up on a leaf, in much the same position as all the preceding seven were found in; it is pale, about half-grown in last skin; reminds one much of *thersites*, so many of the

hairs being white, and, as it happens, the yellow lateral lines less marked than usual, although it has black hairs along the dorsal flanges; indeed, these hairs are so black and conspicuous that they are probably the cause of the rest of the hairs looking so white.

The plant has been closely scrutinised several times a day, yet this larva has escaped detection till now, several of the preceding ones, of course, almost as successfully; it is probable that they come up the leaves very rarely, this one perhaps never before.

April 28th.—Found the ninth larva this morning high up on a leaf. Since 24th the plant has been scrutinised a dozen times without seeing a larva; only one now remains unaccounted for.

The larva on entering last skin shows very white (really colourless) lateral hairs, with sundry nearly black dorsal ones, and the contrast is striking; later both sets of hairs become of a rufous tint, as shown in Mr. Frohawk's drawings.

May 1st.—The larva is very similar to those of *A. thersites* and *P. icarus*; almost identical, in colouring, both as to ground-colour, dorsal and lateral yellow lines, and oblique markings on slope. It differs in the colours of the hairs. The dorsal hairs are dark as in *icarus* (in *thersites* they are white, except on thorax), but are if anything more conspicuous. The lateral hairs are white at moult as in the two other species, but become rufous or dark afterwards. Altogether the larva is certainly much more like that of *icarus* than that of *thersites* is to either of them.

The remaining larvae were brought from the refrigerator into a warm room on March 29th; three moved the next day, but they delayed eating, though not quite so long as the first number, and none took the third moult till April 22nd.

May 4th.—Of the last lot of larvae brought up all seem now to be in 4th instar, the last one moulting to-day. They hung fire very much before beginning to eat, and seemed to eat more before moulting than the first lot did. Some of them are very dark in colour, hardly any trace of green, at any rate of the usual lively green, being present, and the yellow stripes are hardly visible, but the dark band of mid-slope is marked; others are light green with yellow flange stripes, and have much the same facies as those in last instar, but of course smaller.

Pl. LXXXV shows the larva in last instar, two drawings

by Mr. E. C. Knight and two by Mr. Frohawk, of which one shows the remarkable aspect of the recently moulted larva when seen from the front.

The skin armature is shown in Pl. XCV, fig. 33, and various details in the following plates.

April 28th.—Larvae Nos. 1 and 2 have apparently fixed for pupation, one at angle at top of tin, the other at bottom under leaf scraps. So far as can be seen without disturbance, there is no girth or cocoon material, though probably a pad.

When the larvae reach this stage, they become rather shorter and thicker, not at first very different in colour, though later a little duller; the surface has a smooth glazed look, and the slope assumes the smoothed surface with a double (upholstered hollow) almost precisely as described and figured in my account of the larva of *thersites* (Trans. Ent. Soc. 1914, p. 197, figs. 7 and 8, Pl. XXVII).

May 8th.—No. 1 pupated. Those noted as set up for pupation, April 28th, proved not to be so, but moved again, choosing fresh places; others since have fixed themselves up, some making quite a cocoon.

May 28th.—The larva likes to secure a narrow space, almost a tube in which it nearly fits if possible, and spins some threads both above and below it, very flimsy and only noticeable as an anterior and posterior defence, when the space is very narrow; in other cases they amount to a little apparently meaningless spinning. The two sets of threads appear to be quite separate and not parts of a "cocoon," nor do they show any approach whatever to either a girth or a pad, though the larva skin may adhere lightly to the lower silken diaphragm.

The pupa lies quite unattached, the larva skin adherent, in all my specimens, to the last segments.

When quite mature, but before the eyes darken, the pupa is pale ochreous as to head, appendages and wings, gradually passing on the thorax into a pale greenish and on the abdominal dorsum quite a light green, with an ochreous overshading and a dark dorsal line (dorsal vessel). The dorsum (except over dorsal vessel) and sides have numerous short fine hairs of a brownish colour (the appendages have none). The spiracles are pale.

The length is 11·0 mm., 11·5 mm. and one specimen only 10·0 mm. It must be remembered that these belong to the smaller Pyrenean (*rondoui*) form.

The width is 4·5 mm., and the height 4·0 mm. at 4th abdominal segment. The form is the one usual in *Agriades*, but the waist is not so marked as in most other species of *Agriades* and *Polyommatus*, etc.

June 8th.—No. 1 emerged, ♂.
June 9th.—No. 2 emerged, ♂.
June 10th.—Nos. 3 and 4 emerged, ♂ ♂.
And others at later dates.

I reared altogether 7 ♂♂ and 4 ♀♀, they are of the var. *rondoui*, i. e. the Pyrenean form in which the underside spotting is pronounced to about the same degree as in normal *icarus*, which they therefore resemble much more than they do the heavily spotted and more typical form found in Dauphiné and the Southern Alps.*

There is amongst them, however, no specimen of *ab. rondoui* in which the weakening of the spots is much more pronounced. Of the males, several have very distinct discal spots, and two or three have dark chevron marks round the hind margins of the hindwing. The ♀♀ have the orange marginal lunules very poorly developed, one having three only, towards the inner margin of the hindwing.

* Hübner's figure shows a form intermediate between the Dauphiny form and the var. *rondoui*.

Explanation of Plates LXXXIII–CIII

Plate LXXXIII. Fig. 1. Larva in 3rd (hibernating) instar, enlarged about 7 diameters (Sept. 12, 1914).
Fig. 2. Another specimen same date.
Fig. 3. Another view of larva in fig. 2.
Fig. 4. Another view of larva in fig. 1.
Fig. 5. Larva in 4th instar, enlarged about 5 diameters (March 19, 1915).
Fig. 6. Another specimen.
Fig. 7. Another specimen (March 29, 1915).
Fig. 8. Leaflets of *Astragalus monspessulanus* eaten by first-stage larva × 6 or 7.

PLATE LXXXIV. FIG. 9, 10. Larva just entered 4th instar × about 8 (April 1915).
FIG. 11. Another specimen × about 5.
FIGS. 12, 13, 14. Larva found on Simplon route, May 1915.

PLATE LXXXV. FIGS. 15, 16. Larva in last instar (April 27, 1915) × about 4. (E. C. Knight.)
FIG. 17. Full-grown larva × about 4. (F. W. Frohawk.)
FIG. 18. Front view of larva, newly moulted into last instar. (F. W. Frohawk.)
FIG. 19. Dorsal hairs of full-grown larva highly magnified. (F. W. Frohawk.)
FIG. 20. Pupa × 3. (F. W. Frohawk.)
FIG. 21. Lenticle bristle and reticulations of dorsal abdominal surface of pupa highly magnified. (F. W. Frohawk.)

PLATE LXXXVI. FIG. 22. Leaves eaten by young larvae of *A. escheri* × 4½. The opening of entry and the excavated area are well seen.

PLATE LXXXVII. FIG. 23. Egg and eggshell × 80.

PLATE LXXXVIII. FIG. 24. Micropyle × 350. (Clark.)
FIG. 25. Larva on *Astragalus exscapus* (Main), showing how it burrows into the growing heart of the plant.

PLATE LXXXIX. FIG. 26. Skin of larva in 1st instar × 60.

PLATE XC. FIG. 27. Another specimen × 60.

PLATE XCI. FIG. 28. Skin of larva in 2nd instar × 29.

PLATE XCII. FIG. 29. Skin of larva in 3rd instar × 22.

PLATE XCIII. FIG. 30. Skin of larva in 4th instar × 20.

PLATE XCIV. FIG. 31. Skin of larva in 4th instar, last segment × 35.
FIG. 32. Skin of larva in 4th instar. Honey-gland region × 100.

PLATE XCV. FIG. 33. Skin of larva in last (5th) instar × 14.

PLATE XCVI. FIG. 34. Skin, last instar. Prothorax × 35.
FIG. 35. Skin, last instar. Honey-gland region × 35.

PLATE XCVII. FIG. 36. Skin, last instar. Prothoracic plate × 100.
FIG. 37. Skin, last instar. Honey-gland × 100.

PLATE XCVIII. FIG. 38. Skin, last instar. Margins (right and left).
FIG. 39. Skin, last instar, sides of 4th and 5th abdominal segments × 40.

Note curious structure in upper figure where there is a tear (a blank) in lower one.

PLATE XCIX. FIG. 40. Last instar. Dorsal region of 4th and 5th abdominal segment × 40.
FIG. 41. Last instar. Proleg of 4th abdominal segment × 100.

PLATE C. FIG. 42. Two stereoscopic photographs of pupa by Mr. Main × 4.

PLATE CI. FIG. 43. Plates of pupal head × 30.

FIG. 44. Plates of ventral surface and cremastral area of pupa × 30.

PLATE CII. FIG. 45. Plates of prothorax and dorsal head-piece of pupa × 30.
FIG. 46. Plates of metathorax × 30.

PLATE CIII. FIG. 47. Pupa. Spiracular region of left side of fourth abdominal segment × 40.

XXII. *Notes on the early stages of* Scolitantides orion, *Pall.*

By T. A. Chapman, M.D.

[Read October 6th, 1915.]

Plates CIV–CXVII.

The full-grown larva of *Scolitantides orion* is very well known and has been figured, but not altogether satisfactorily. Most of the other details here reported are more or less still undescribed.

The butterfly lays her eggs freely in captivity on various Sedums, *telephium* perhaps for choice.

The egg is of ordinary Lycaenid shape, flat on top with rounded sides, in short, cheese-shaped, 0·65 mm. wide and just half that height, viz. 0·325 mm.; the rounding of the sides reduces the flat top to 0·45 mm. across. The network has little or no knobbing at the junctions of the lines, the special peculiarity of the egg is that the meshes of the network are, on top, radially long, very narrow across, and on the sides of very similar form, but the long axis is horizontal. The result of this sudden change of form of the cells at the margin of the top is to give the appearance of a raised border or crown, which is not strictly the fact.

The larva as soon as hatched burrows into the substance of the leaf, which is thick and succulent, generally just under the cuticle, but sometimes deeper. The larvae are practically colourless and take the colour of their food, so that it requires a very careful search to detect them. On one occasion I had some eggs sent me and received the empty shells, but believed the larvae had died or otherwise been lost. Luckily I kept the plant, and after a time the larvae were accounted for.

Scolitantides orion, newly hatched May 26th, 1912, is about 1·2 mm. long, slaty grey or nearly colourless, with conspicuous black spiracles and black bases to trapezoidal hairs; hairs I are dark, the rest nearly colourless. As it grows it acquires a reddish-brown dorsal band, and when full-fed in this skin shows some dark markings on "slope." When waiting for moult the dorsal band is triangular on each segment, narrow at front of segment, wide behind;

E.C. Knight, del et pinx.

Adlard & Son and West Newman

LARVAE OF SCOLITANTIDES ORION.

Photo, F. N. Clark. *Anglo-Engraving Co., Ltd.*

S. ORION, EGGSHELLS × 60.

Photo, F. N. Clark. *Anglo-Engraving Co., Ltd.*

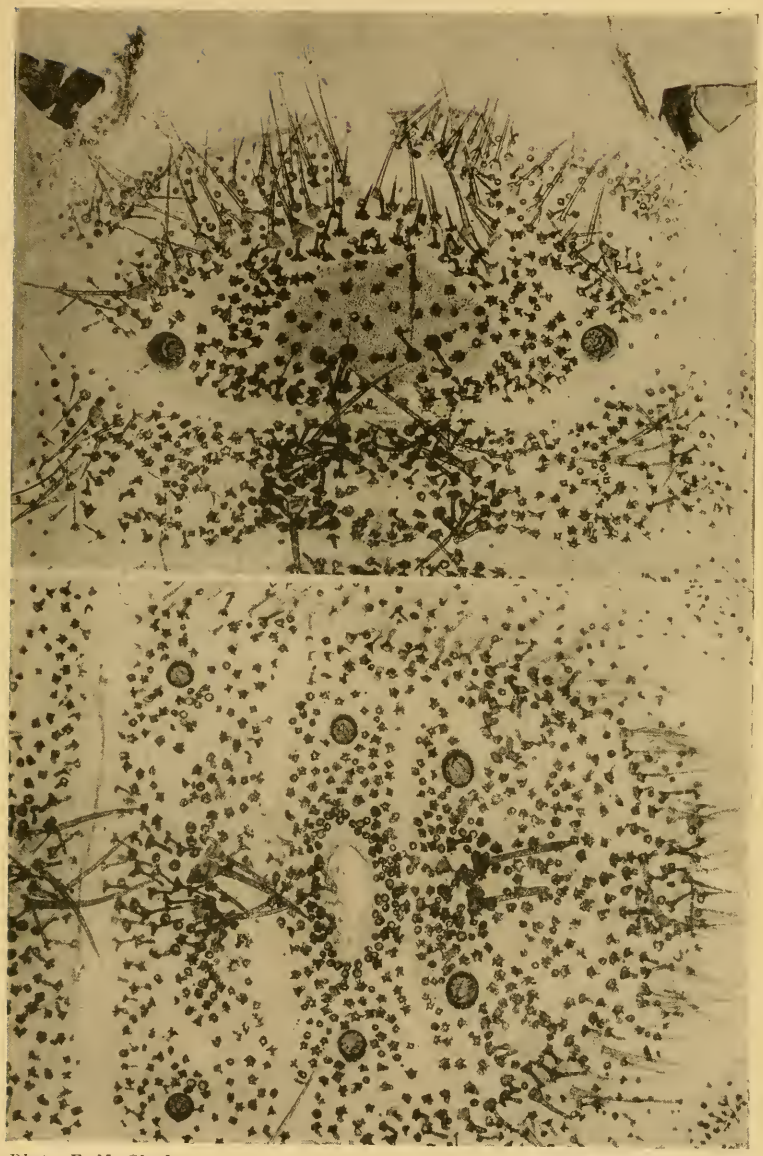
S. ORION, SKIN OF FIRST STAGE LARVA × 40.

Photo, F. N. Clark. *Anglo-Engraving Co., Ltd.*

S. ORION, SKIN OF SECOND STAGE LARVA × 30.

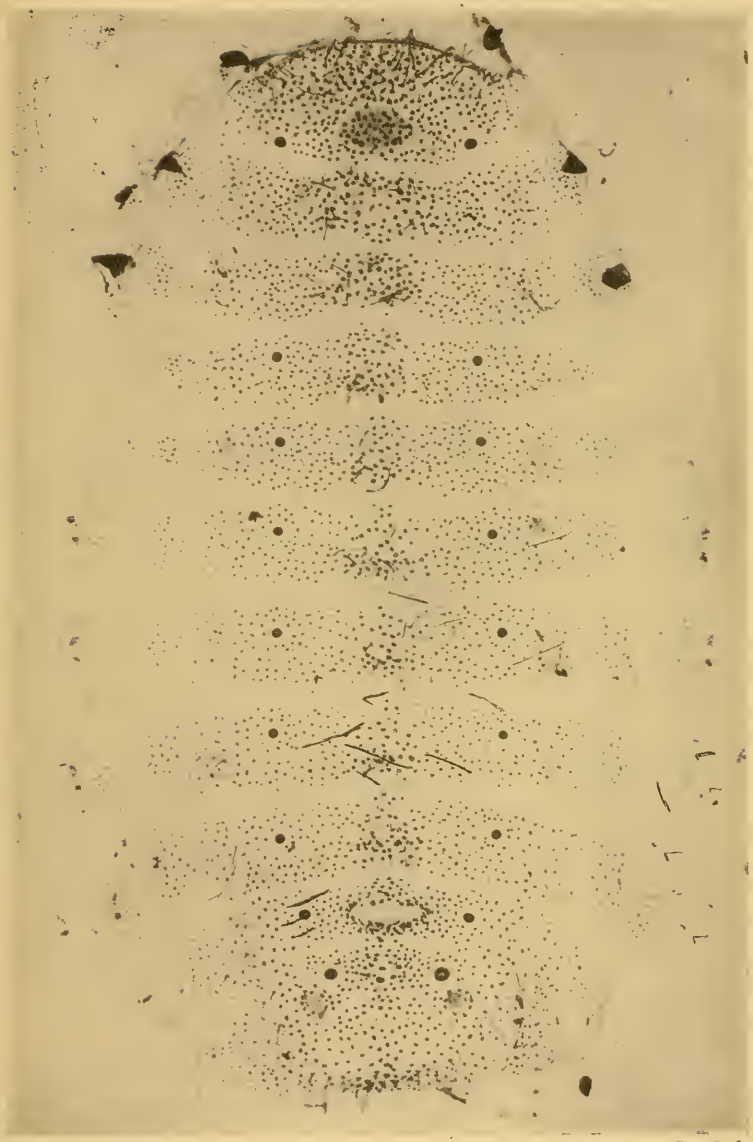
Photo, F. N. Clark. *Anglo-Engraving Co., Ltd.*

S. ORION, SKIN OF THIRD STAGE LARVA × 15.



Photo, F. N. Clark. *Anglo-Engraving Co., Ltd.*

S. ORION, PROTHORAX AND LAST SEGMENTS OF THIRD STAGE LARVA × 40.



Photo, F. N. Clark. *Anglo-Engraving Co., Ltd.*

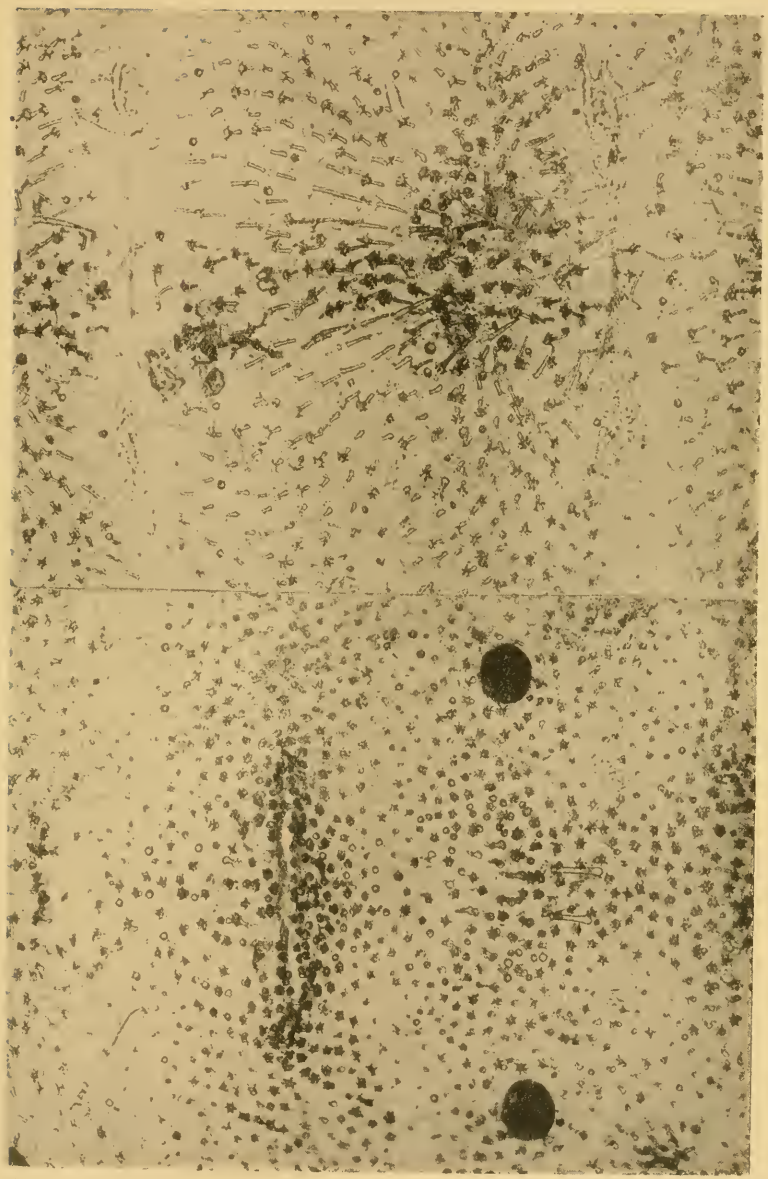
S. ORION, SKIN OF FOURTH STAGE LARVA × 18.

Photo, F. N. Clark. *Anglo-Engraving Co., Ltd.*

S. ORION, FOURTH STAGE LARVA, PROTHORAX AND HONEY GLAND × 100.

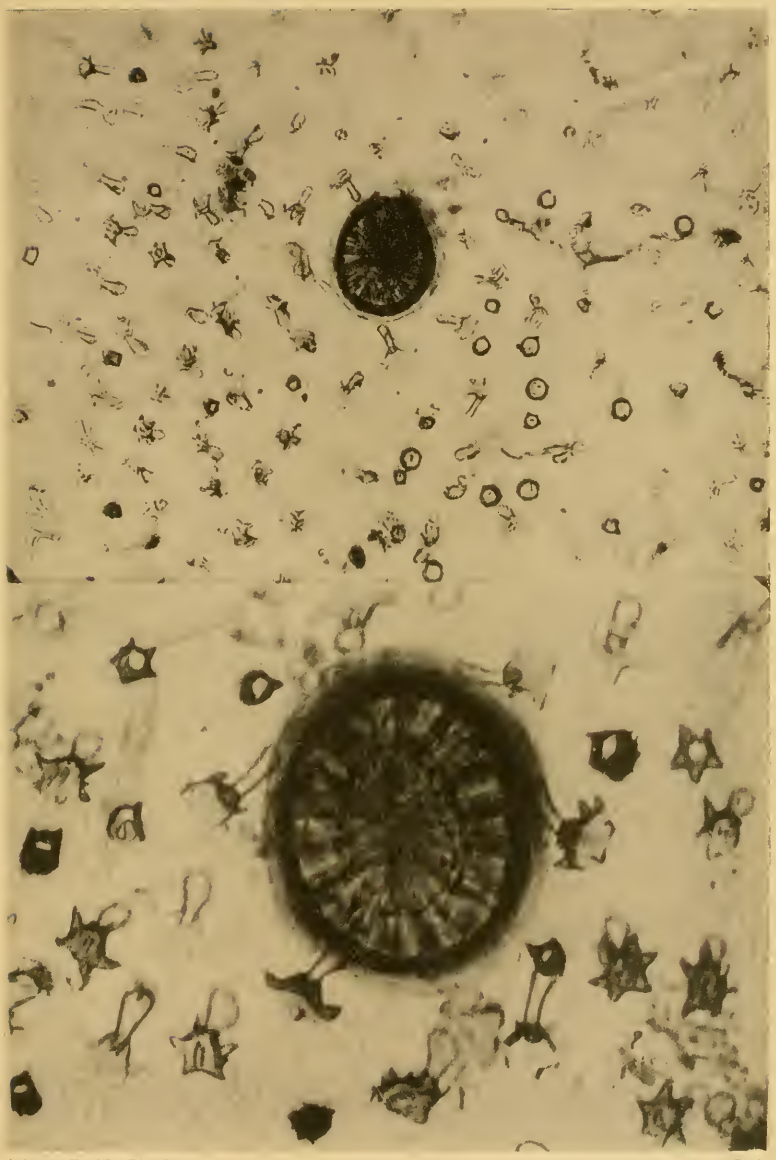
Photo, F. N. Clark. *Anglo-Engraving Co., Ltd.*

S. ORION, SKIN OF LAST STAGE LARVA × 9.



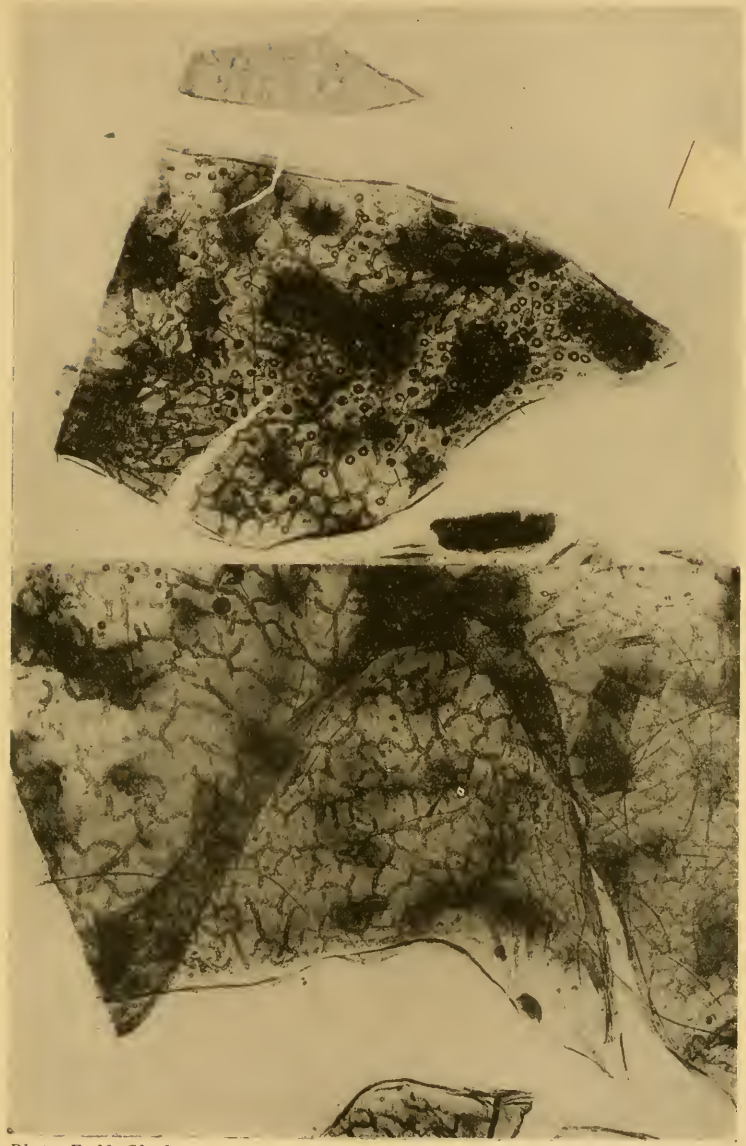
Photo, F. N. Clark. *Anglo-Engraving Co., Ltd.*

S. ORION, LAST STAGE LAVA, DORSUM FIFTH ABDOMINAL SEGMENT AND HONEY GLAND × 40.



Photo, F. N. Clark. *Ang'o-Engraving Co., Ltd.*

S. ORION, LAST STAGE LARVA, SPIRACULAR REGION × 100 and × 250.

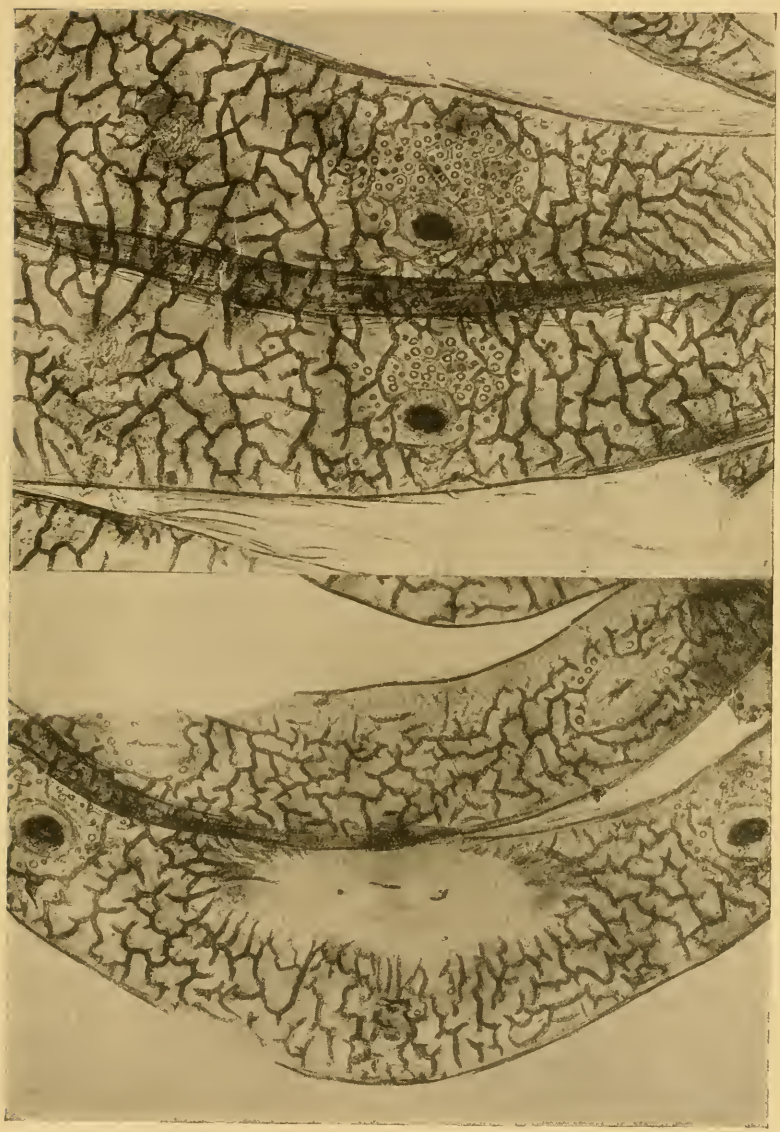


Photo, F. N. Clark. *Anglo-Engraving Co., Ltd.*

S. ORION, PUPA, PROTHORAX, HEADPIECE AND METATHORAX × 45.

Photo, F. N. Clark. *Anglo-Engraving Co., Ltd.*

S. ORION, PORTION OF WING AND CREMASTRAL AREA OF PUPA × 45.



Photo, F. N. Clark. *Anglo-Engraving Co., Ltd.*

S. ORION, PUPA, SPIRACULAR AND HONEY GLAND AREAS × 45.

the markings on slope form a narrow reddish nearly straight line at about level of III. There is a trace of reddish line on flange, most obvious posteriorly. The dorsal outline slopes from 1st abdominal to tail, the length is about 2·4 mm. In feeding in 1st instar the larva mines into substance of leaf in a mine twice (or more) its own length. (It was put on *Sedum telephium*, which it readily took.)

In the first instar the arrangement of hairs and lenticles accords very much with the usual (say the Plebeiid) type. This especially obtains with the prothorax and prothoracic plate. But marked differences occur. On the 2nd thoracic segment there is the usual dorsal lenticle, but the hair outside this is very small and weak, instead of being (as usually) comparable with the inner one. On the posterior part of the segment and on those behind to 6th abdominal, hair II is very small, and is very posterior to I, instead of, as in Plebeiids, more than half the size of I and lateral as much as posterior to it. The minute accessory in front of these is very distinct. The subdorsal lenticles on 1st to 5th abdominal are only one on each side, instead of two. The 6th abdominal segment has the usual reversed pair. On the 7th and 8th, tubercle II is as usual represented by a lenticle; but there is also a very unusual lenticle behind tubercles III on the 7th segment. There are present the usual lenticles, one in front of the spiracle on the prothorax, and the marginal one (outside the spiracle) on the 1st abdominal. The two supraspiracular hairs (III) are very minute, less than 0·01 mm. long, of an oval or clavate form. The three marginal hairs are more than usually in a (longitudinal) line, instead of the middle one being further out than the others.

From eggs laid at Pallanza about May 18th, 1914.

May 28th.—After being at rest for two days the oldest specimen has moulted into 2nd instar and is eating the cast skin. I do not remember this occurring in any Plebeiid. Its colouring is like that of 1st instar when full-fed.

June 2nd.—The oldest larva is now 4·5 mm. long, but can only be in 2nd instar. It is of usual Lycaenid form, with lateral flange especially marked in posterior segments owing to dorsal flattening.

Its colour is a very pale yellowish green, paler than straw-colour, with a broad brown-red dorsal band very wide on 2nd and 3rd thoracic, a little expanded towards posterior margin of each seg-

ment; it contains on each segment some pale transparent spots on each side (as well as hair bases); there is an interrupted red line rather above middle of slope, consisting of a red spot towards posterior margin of each segment, continued to front of segment, forwards and upwards by a paler reddish colouring, fading out as it passes forwards; it is about half-way between spiracles and dorsal band. Spiracles are black, not very conspicuous, being small, probably because the larva is very full-fed in this instar; along the flange is a reddish line, very weak in front, conspicuous posteriorly, and joining at posterior margin of flange with dorsal and slope lines. Head black. Seen laterally, the segments mesoth. to 6th abdominal are raised as rounded eminences highest at front margin of segment; legs blackish, underside pale without coloration.

June 4th.—Largest larva in 3rd instar; ate skin at 2nd moult. Coloration same as that of 2nd instar, except that black hair bases are numerous and give a tone to the larva, and the lateral line is hardly visible on anterior segments.

June 9th.—The rest are now in 2nd instar, about 2 mm. long, yellowish white, broad red dorsal band, expanded a little in each segment, and a minute red dot in middle of slope of each segment. They mine into the leaves, but always extrude frass, even when in first skin; they are well enclosed in the mine. In second skin the mine is more open, and the covering cuticle is not often left.

In the last instar there is a remarkable resemblance of the front of the larva, when viewed in profile (laterally), to some small mammal, especially perhaps a shrew mouse. When the head is retracted, the prothoracic plate marks a depression, and the front of the prothorax extends as a flap, looking much like a snout, whilst the first spiracle suggests an eye.

Pl. CIV, fig. 3, does not show this, but it shows how easily this effect would be produced by retracting the head and extending forward the anterior margin of the prothorax. This resemblance is not on too small a scale to prevent it from suggesting to some predaceous insect enemy, say an inch or two off, a shrew or other doubtful presence at, say, 8 or 9 inches away.

July 1st—

A newly changed pupa is of Lycaenid form, but rather more pointed than usual at the cremastral extremity, by which it appears to hold, the larval skin being got rid of. The wings are green and translucent, but the rest of the pupa is white with a faint creamy tint, and has a rather broad brilliant rose-pink dorsal line, with

some pink shadings, half-way between this and spiracular line. The curved eye is largely black, in two thin lines and threads between them; there soon appear also greenish patches on the prothorax, head and wings, consisting of very small round spots, either separate or aggregated; these look as if they were to be darker when the pupa is mature. The abdomen is thicker and wider than the thorax, and the waist is definite, but not marked.

The dark spots a few hours later appear all over the pupa, and gradually darken as does the ground-colour of the pupa; the dorsal line becoming dark also, but less distinct.

The photographs of portions of the pupa skin will show its sculpture and armament better than much description. The network is more netted and less dendritic than in Plebeiids, thus more approaching Chrysophanids and Thestorids, especially also in the presence of "rosettes" at the junctions. The larval armaments are, however, strictly of Lycaenid pattern.

Explanation of Plates CIV–CXVII.

Plate CIV. Fig. 1. Larva of *S. orion* in 3rd instar.
Fig. 2. Larva of *S. orion* in 4th instar.
Fig. 3 and 4. Larva of *S. orion* in last (5th) instar.

Plate CV. Eggshells × 60.

Plate CVI. Skin of first-stage larva × 40.

Plate CVII. Skin of second-stage larva × 30.

Plate CVIII. Skin of third-stage larva × 15.

Plate CIX. Prothorax and last segments of third-stage larva × 40.

Plate CX. Skin of fourth-stage larva × 18.

Plate CXI. Skin of fourth-stage larva. Prothoracic plate and honey-gland × 100.

Plate CXII. Skin of fifth (last) stage larva × 9.

Plate CXIII. Last-stage larva, dorsum of fifth abdominal segment and honey-gland region × 40.

Plate CXIV. Last-stage larva, fifth right spiracular region × 100 and 7th × 250.

Plate CXV. Pupa skin, prothorax and dorsal head-piece and metathorax × 45.

Plate CXVI. Portion of wing of pupa and cremastral area × 45.

Plate CXVII. Pupa skin, spiracular area of 5th and 6th abdominal segments × 45, and dorsum of 7th showing scar of honey-gland × 45.

Further Notes on the Eggs of Butterflies.

A Supplement to C. F. M. Swynnerton's Memoir XIV (p. 317), *Experiments on some Carnivorous Insects*, etc.

I have made a point of making coloured drawings of any butterfly eggs that I have been able to obtain, *as seen against their usual natural background*; for it is only in this way that their relative conspicuousness can be assessed. I had hoped to incorporate these drawings in a plate to be published with this paper; but, although this has proved to be impossible, it is worth repeating that the conspicuousness of many of these eggs relatively to the point of vision of the closely-searching bird is very great indeed. The contrast of the ivory-like eggs of *Danaida chrysippus* with the commonly quite dark green leaves of the species of *Asclepias* on which it feeds, and that of other Danaine and Acraeine eggs—bright yellow or whitish and before hatching purplish brown—with the leaves of *their* food-plants is quite marked. This conspicuousness is furthermore often much enhanced by the eggs being laid many together. To watch an *Amauris*—slowly, deliberately and with carelessness of attack—laying her eggs one after another on a highly-exposed leaf of *Cynanchum*, the eggs themselves more or less closely spaced and visible to the observer ten feet away, must convince any one who knows the hurried laying of some other butterflies of the existence of special protection.

Eggs of certain species are, of course, laid sometimes on the upper surface, sometimes on the lower, of a leaf, sometimes on the petiole or a twig; and the degree of conspicuousness varies accordingly. An egg laid under a leaf should commonly be fairly visible to searching birds which make a point of minutely examining the undersides of leaves; but its appearance there, in relative obscurity and seen against the light, is naturally somewhat different from what it would be under other circumstances. Yet it is often conspicuous enough as a darker object than the rest of the leaf, for the under surface generally receives

enough reflected light from the sunlit ground or other leaves below to make the egg's detail easily visible.

The eggs of *Pyrameis cardui* (blue-green), *Antanartia schoeneia* (grey-green) and *Eurytela hiarbas* (glassy, slightly yellowish green) are all less contrasted with the leaves of their respective food-plants than are the eggs of the *Danainae* and *Acraeinae*. They do not at once catch the eye as these latter are apt to do, and, by the careless searcher or when not looked at directly, may often be passed over. Yet, searched for well, even these are very fairly visible, and I have noticed that the eggs of *Antanartia* are somewhat particularly so when laid beneath a leaf. In hairiness (shared with *Byblia*) the *Eurytela* egg resembles that of its food-plant at Chirinda. This certainly aids in such concealment as it enjoys, yet, when the egg is detected, this same hairiness gives it great distinctiveness.

A very beautiful egg, if a small one, is the clear cut-glass egg, just tinged with green, of *Hypolimnas misippus*, in fair contrast to the leaf of *Portulaca*. A curious egg is that of *Pseudacraea lucretia*, a half-sphere with a bubbled or honeycombed appearance due to the occupation of the whole exposed surface by closely packed depressions. It is perhaps less in contrast with the peculiar russet or silvery underside of the leaves of its food-plants (*Chrysophyllum* spp.) than a considerable proportion of butterfly eggs are with the coloration of theirs. The green egg of *Charaxes ethalion*, which, with the *Pseudacraea* egg, seemed to be the most readily taken by the ants, matches the green of its food-plant (*Albizzia*) better than any egg I know, especially just at first. Later it develops its ring, a dark brown one, and it then looks not very unlike the extra-floral nectaries of *Albizzia chirindensis*. I have not examined those of typical *Albizzia fastigiata*, its food-plant in Natal. In any case the resemblance, such as it is, is unlikely to have been the result of selection, as the ring is a common feature of *Charaxes* eggs, and even enemies that are easily deceived or are looking carelessly would learn to distinguish the egg from the nectary by its different position on the leaf. I have seen one or two broods of *C. ethalion* (out of a large number) in which the eggs were yellow instead of green.

The strong ringing of the egg of *Papilio dardanus* is perhaps a little more notable, though a *tendency* in that direction occurs in other Papilionine eggs at Chirinda.

Like these, it starts as a light yellowish-green egg, conspicuous through being so much paler than the various Rutaceous leaves on which it is laid—*Teclea*, *Toddalia*, *Vepris*, *Clausena* and *Citrus* of all species. It shortly changes into a dull whitish egg with an irregular purplish or brown-madder ring round its greatest circumference and a dark spot in the centre. There is now a superficial resemblance to the egg of *Charaxes brutus*, though the ring of the latter eventually attains a deeper colour and the shape of the egg is a little different, that of the *Charaxes* having the usual depressed and slightly sculptured top characteristic of the eggs of that genus. An ordinary hand-lens makes the difference clear, and it is probable that such a lens gives us much the appearance seen by the small, closely-peering warbler or white-eye. In *P. dardanus*, as in *C. ethalion*, I have seen a single brood (out of many) in which the eggs, after developing their ring, were yellow, and looked very like those of *Charaxes candiope*. In two broods the eggs were unusually small—more like those of *P. demodocus*.

The resemblance of the eggs of *Atella phalantha* to those of one or two of our commoner Acraeas is even stronger, though the common appearance is again brought about by a common colour and general shape with a somewhat different sculpturing. Apart from the fact that *Atella* is not so very far removed from the *Acraeinae*, we need to know whether all *Atella* eggs are like those of *A. phalantha*. It is early days to suggest mimicry when we do not yet know whether the egg-enemies that recognise by sight discriminate as did the drivers. Nevertheless, the latter's refusals show that a *potential* basis for preference certainly exists, so that the possibility of mimicry is at any rate worth bearing in mind; and the results from the drivers, if they should be more generally applicable, suggest that if there should happen to be mimicry in any of the above resemblances, mnemonic considerations may have contributed to it in even greater degree than differences in grade. I have already suggested, elsewhere (Proc. Ent. Soc. 1915, p. xlii), that such considerations—the principle of increased reminding-power and facilitated recognition—and not Müller's principle of the shared loss, are the real basis of numerical mimicry.

June 2, 1916.

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THE

PROCEEDINGS

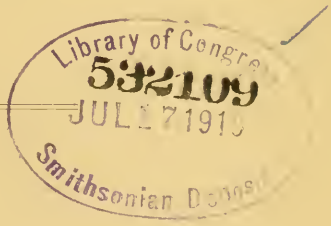
OF THE

ENTOMOLOGICAL SOCIETY

OF

LONDON

1915.



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colour. The larva, which is equally large and as well illuminated as the adult insect, may be recognised by its darker colour and the presence of but a single claw on each foot.

If the luminosity of the adult serves for sexual attraction, it must have some totally different object in the larva. We have to fall back upon the theory of warning colours, to meet this case. But the question occurs: Why should an insect that travels only in the dark require to draw attention to its unpalatability? The same problem occurs in the case of the winged male, which does not require to advertise its presence when seeking the apterous female. I have repeatedly observed, in fact, that the male shuts off its light when approaching a "calling" female.

Mr. Donisthorpe observed that both the eggs and larvae of the English glow-worm are luminous.

An Ingenious Device.—Dr. H. Eltringham exhibited an instrument made to his instructions by the Cambridge Scientific Instrument Company, for cutting paraffin blocks perfectly square preparatory to placing them on the microtome. He remarked on the difficulty usually experienced in cutting these blocks and the impossibility of obtaining good section ribbons if the paraffin containing the object were not cut perfectly square. The instrument consisted of a carrier for the block-holder sliding in an inclined groove of V section, and on the opposite end of the bed-plate a pair of level guides on which to slide the knife. The carrier had on it a square plate at right angles to its long axis and arranged to slide in the V groove. The inclination of the groove gave adjustment for height, whilst the square plate on the carrier brought the latter, and consequently the paraffin block, into four possible positions, each corresponding to one side of a square, in relation to the travel of the knife. With this instrument a paraffin block could be cut square with absolute precision and of any size in a few seconds.

The Life-history of Agrotis lucernea.—Mr. Lupton communicated the following notes:—

Mr. Joseph Walker of Torquay has investigated the life-history of this moth, and, as it differs very materially from that set out by most of our authorities, he has asked me to com-

municate it to your Society. These investigations refer only to observations made in Torquay. The imago appears in June and is over by the middle of July. None lay eggs at this time, consequently no larvae are found in the following months. The grass on which the larvae would feed in this district in quite burnt up in August. In the autumn female imagines appear at ivy and usually lay eggs directly after boxing; these produce larvae which feed, as the books say, during winter and spring. The autumn specimens are all females, and their condition is poor compared with June ones. Is it possible that this insect aestivates during August and September? Is there any other British Lepidopteron which does this? Mr. Walker's assertion about the occurrence of *lucernea* at ivy has been verified by two gentlemen from the London district, and I have found in an old notebook of the late John Buckton, who collected in Torquay very assiduously, a note saying that he took *lucernea* at ivy, September 26th, 1860. There is no reason to suppose that it is double-brooded, therefore what becomes of the females between July 15th and September 20th?

Mr. Walker has also found *A. saucia* feeding on roots of plants growing near the seashore (*Arenaria*, etc.). Also larvae of *Epunda lichenea* feeding in quantity on garden cabbage.

The habits of the Australian Buprestid "Fire-beetle," Merimna atrata, Lap. et Gory.—Prof. Poulton exhibited specimens of the above-named beetle and read the following note, which has been sent to him by Mr. H. M. Giles, F.E.S., of the Zoological Gardens, South Perth.

"This beetle is known locally as the 'Fire-beetle' from its extraordinary habit, which is I think quite unique. It is only seen when a bush-fire is raging—in fact, the best way to take it is by starting one. The beetles seem to come from all quarters and fly straight into the fire, alighting and running about the hot steaming branches and sometimes even over the parts that are glowing red, yet without injury to the tarsi. It is one of the most agile species known to me, and as alert and active as an eagle. So far as I am aware its life-history is unknown, but I think it likely that the larvae feed in the roots of the burnt shrubs. I am endeavouring to gain further

knowledge of the beetle's habits which are so unlike those of other Buprestids." The habit was also briefly mentioned in the "Agricultural Gazette," N.S.W., quoted in Froggat's "Australian Insects," p. 160.

Prof. Poulton said that the instinct of the beetle, like the wonderful fire-resisting powers of many Australian trees, had probably been developed in ancient times as a response to bush-fires due to friction or some other natural cause. Mr. C. F. M. Swynnerton had suggested in conversation the probable hypothesis that the beetle is stimulated by the scent of the fire to seek a spot where its larvae can feed upon wood from which volatile protective substances have been driven by heat. Prof. Poulton hoped that Mr. Giles would be able to obtain decisive information concerning this interesting and extreme manifestation of the well-known instinct which impels many Coleoptera to lay their eggs in burnt timber, probably thus ensuring some chemical or physical advantage in the larval food. Mr. G. C. Champion had recently drawn attention (E.M.M., 1913, pp. 109, 110) to Mr. A. H. Manee's observation in N. Carolina that the Buprestid *Melanophila notata*, Lap. et Gory, known locally as the "Fire-bug," was attracted in numbers to a blazing pine-stump and settled near by. Mr. Champion also pointed out that the allied *M. acuminata*, de G., had been taken on charred pines near Woking and in the New Forest.

Comm. Walker said that the "fire-beetle" was taken at camp-fires in New South Wales, and Mr. Champion observed that in Canada another Buprestid was known as the "fire-beetle" in consequence of similar habits.

The Australian Buprestid beetles, Stigmodera conspicillata, White, and S. cyanura, Hope, proved to be female and male of the same species.—Prof. Poulton exhibited the male and female of *S. conspicillata*. The two sexes had been bred by Mr. H. M. Giles from the same food-plant, *Melaleuca* sp., and had also been captured by him *in coitû*, thus confirming Mr. C. O. Waterhouse's determination in the collection of the British Museum. *S. cyanura* had been originally described by White as a variety of *conspicillata* and subsequently by Hope as a different species. Hope had also re-described the female *conspicillata* as *signaticollis* and had

given the further name of *subtrifasciata* to another example. This latter specimen, together with Hope's types of *cyanura* and *signaticollis*, were exhibited to the meeting. Prof. Poulton thought it was likely that the conclusive evidence now obtained by Mr. Giles would lead to the correct understanding of other species of *Buprestidae* with sexes of very different patterns.

The African ant Megaponera foetens, F., and its raids upon Termites.—Prof. Poulton said that he had recently received notes upon the habits of this ant from three different observers. The first was contained in a letter written from Aberdeen on September 24, 1914, by Mr. C. O. Farquharson.

" I had to do a month's overtime on the Coast which caused me to miss Dr. Lamborn. I spent the last month at Agege, near Lagos, a good district, but my time there was rather short. I got some nice ants, however, which I am not sure that I have heard Dr. Lamborn describe—large black ones nearly as big as our so-called ' Stink-ants ' (*Paltothyreus*), which indeed I once thought they were. They go however in an ' army,' and on their forays seem to specialise on Termites. I have seen them on their return from the war carrying the large and fierce soldiers of the Termites. To me their most curious feature was their habit of hissing when disturbed. Even at the sound of my voice as I bent over their line of march, they would scatter with quite a loud hissing. I traced them to their nest, but failed to find any sign of a queen. My time was, however, unfortunately very limited and they were exceptionally fierce—Huns, in fact, among the ants."

Shortly after the date of the above letter Mr. Farquharson visited Oxford, and brought the specimens of the ants and their prey which were exhibited to the meeting.

The second letter was written by Dr. G. D. Hale Carpenter in Nov., 1914 :—

" I am writing now from Kyaka Fort, in German territory, 30 miles S. of the Uganda frontier on the S. bank of the Kagera River. In order to obtain a defensible position we have occupied a piece of German territory lying south of the actual frontier which lies across open plain and is quite impossible as a line of defence. The Kagera River is a natural barrier and only passable at certain places, one of which is

guarded by the fort which the Germans erected against a British advance—but is now being used for the opposite purpose ! ! The river is broad, very deep (18 feet a yard away from the bank) and swift, and lined by dense banks of papyrus, so it is an excellent barrier. The country round is open plain, absolutely flat. Parts are covered by fine forest continuous with the Tero Forest (where Neave collected). If only I could collect there ! Other parts are just grassy plains, sometimes without trees, sometimes with thorny Acacias. Here and there rise low grassy hills out of the plain, from the top of which very extensive views can be had. From the open nature of the country it is a poor locality for butterflies. But *Terias* is here and I might get some interesting species. It is a genus I am very little acquainted with. *Hypolimnas misippus* is commoner here than at any place I have been to—I think more abundant than its model *Danaida chrysippus*. At one place I was at (Simba) on the way down more moths came to light than I had ever seen before in Africa, and all were new to me. I did wish I had had a bottle. But we have to travel very lightly loaded, 10 porters for *everything*, so insect apparatus had to be left behind. The birds round here are many of them new to me—also the insects. There is a large black ant which goes about in parties and raids Termite hills : one sees them coming back in close column formation each bearing a mangled Termite worker, presumably for food. When interfered with they make a loud stridulating noise."

Prof. Poulton, knowing that Mr. S. A. Neave had met with the same species of ant, asked if he would allow his observations to be recorded with those of Mr. Farquharson and Dr. Carpenter. Mr. Neave had kindly replied on January 29, 1915 :—

" So far as my recollection goes the ants are common all over tropical Africa, especially in Nyasaland and Northern Rhodesia. They are much in evidence because the raiding parties are particularly fond of using native paths. These parties usually consist of roughly from 80 to 120 individuals, which march in ranks five or six abreast. When somewhat disturbed they produce a stridulating sound which resembles a faint hissing and is clearly audible five yards away. When more seriously disturbed they break their ranks and rush out

in all directions. They sting severely (I have been stung more than once) and can also, I think, bite. I am not quite sure whether they do at the same time produce an unpleasant smell. Many ants of this type do, but I am not quite certain whether it is true of this species. When I was at Kambove in 1907, there was a nest of this species under the house I lived in for some weeks. A raiding party (not by any means *all* the workers) went out every morning between 8 and 9 a.m., and returned at various times between noon and 3 p.m., generally about 1 p.m. So far as I remember, they never failed to bring back a number of Termites. It is perhaps noteworthy that when a raiding party is returning only a certain number are laden, the advance- and rear-guard and the individuals at the ends of the files usually ' having their hands free.'

" I once in the Luangwa Valley, I think in 1908, witnessed the end of a fight between these ants and some Termites. I am not at all clear how it was that the Termites were outside the nest and whether the ants had themselves entered the nest or decoyed the Termites out in some way. The fight took place on a bare spot near the nest, which was not a true mound, and therefore the Termites may have belonged to one of the species which moves about in the open. The fight was just over when I arrived, and the ants were beginning to go off with their spoils. They had suffered one casualty, a single individual having been snipped in half by a large soldier Termite. So far as I could see workers chiefly and not soldier Termites were carried off. After the battle was over the behaviour of the Termites was interesting, as numbers of workers came out of the nest and inspected the field, which was strewn with dead and wounded, the ants having killed and injured more than they could carry away. The wounded soldier Termites but not the workers were then taken back into the nest."

Prof. POULTON concluded that *M. foetens* was almost certainly the ant referred to by Captain C. H. Stigand in " Hunting the Elephant in Africa, etc.," New York, 1913. The author spoke on pp. 248–250 of often meeting in the bush long streams of black ants which had just been raiding Termites' nests. " Every member of the party is carrying a Termite in his

mandibles. Sometimes one sees the wounded being borne home in their midst, some of them bristling with hostile Termites, who have died with their jaws firmly embedded in their black foes. The victors do not disembarrass their friends' bodies of these appendages. . . ." Captain Stigand also described the blind rough-and-tumble of the battle, which was usually subterranean but might be seen by breaking open a Termites' nest in front of an invading army. He said that the smaller workers were generally the bravest and the first to enter the termitarium. The Termites defended themselves by ejecting from the mouth a fluid which it was suggested might be formic acid. This fluid although a powerful defence was gradually expended. The author also stated that he had "several times noticed a minute fly persistently following round an ant carrying a dead Termite," and he concluded "that it is awaiting a suitable opportunity to slip in and lay its eggs in the body." Captain Stigand did not mention the sound produced by the ants.

Mr. Crawley remarked with regard to *Megaponera foetens* that large ☿ ☿ only had been described by Fabricius, the small ☿ ☿ having been subsequently described as *crassicornis* by Gerstäcker. He said that no ♀ ♀ were known, and that Emery suggested that the large ☿ ☿ function as ♀ ♀, the small ones as ordinary ☿ ☿. He added that the ♂ is known.

Mr. Green said that a Ceylon ant (*Lobopelta* sp.) had a habit of making a sound between stridulation and rustling, and that the leaders wait until the whole column is massed before attacking their prey.

Mr. Donisthorpe observed that stridulation was common in the *Ponerinae* and *Myrmicinae*, and that even in the *Camponotinae*, *Lasius*, which does not possess true stridulating organs, could produce a sound by rubbing one segment of the gaster against another; he added that it was this stridulation which often caused a number of ants to collect at once on any food found, or to come out in defence of the nest.

Mr. Crawley said that some ants (e. g. *Camponotus*) stridulate by rubbing the point of the gaster against the ground, and that this process was used as a signal.

Mr. Swynnerton remarked that some Termites also signal by striking the mandibles on the ground, and also observed that ants are deterred from pushing home an attack by unpleasant secretions, but are ready to attack when the secretion is exhausted.

Mr. Donisthorpe, referring to the covering of lepidopterous larvae with earth by ants, said that this might be explained by their habit of covering any damp or wet place, tar or sticky or otherwise unpleasant object, with bits of earth, etc., and even their own *Aphidae*, rather than by the explanation formerly offered that they were trying to build a bridge. At the same time he had seen in his observation nests ants bringing bits of stick, earth, etc., and putting them into the water in their water-troughs, as if trying to build a bridge.

Mr. Crawley said he had seen ants put earth at the edge of honey before drinking it.

Mr. Swynnerton said that he had seen ants put earth against unpleasant substances, *e. g.* a kind of fly that they found distasteful, apparently to warn off the other ants, for they thereafter became objects of no interest.

Butterflies from Biak.—Mr. Talbot exhibited on behalf of Mr. J. J. Joicey a number of new forms of Lepidoptera from Biak, the largest of the Schouten Islands to the north of New Guinea, collected by Messrs. A. C. and F. Pratt during two months of the summer of 1914. The following is a list of the insects exhibited :—

Papilio othello, ♀ f. *obscurata*, *P. euchenor* f. *comma*, *P. felixi*, *Delias maudei*, *D. multicolor*, *D. bosnikiana*, *D. dohertyi* f. *knowlei*, *D. talboti*, *D. biaka*, *Appias albina* f. *pulverobasalis*, and five ♀ forms, *A. falcidia*, Fruh., ♂ and ♀, *A. ada* f. *solis*, *Pareronia chinki*, *Cynthia arsinoë* f. *bosnikensis*, *Cirrochroa imperatrix*, Sm., ♀, *Cethosia chrysippe* f. *schoutensis*, *Symbrenthia hippoclus* f. *nigroapicalis*, *Mynes geoffroyi* f. *aureodiscus*, *Charaxes latona* f. *marcia*, *Hypolimnas pithoeka* f. *fumosus*, *Doleschallia bisaltide* f. *nigromarginata*, *D. noorna* f. *fulva*, *Neptis shepherdi* f. *gregalis*, *N. venilia* f. *albopunctata*, *Euthalia aeropus* f. *angustifascia*, *Prothoe australis* f. *satgeii*, *Elymnias cybele* f. *umbratilis*, *E. viridescens* f. *cinereomargo*, *Melanitis*

amabilis f. *angulata*, *Dicallaneura princessa*, Sm., ♂ and ♀, *Elodina biaka*, *Euploea tripunctata*, *E. incerta*, *E. albicosta*, *Taenaris scylla*, Stgr., ♀, *Asota intermedia*.

Mr. Talbot also read the following notes on the Affinities and Distribution of the new Forms :—*Papilio othello*, first obtained by Doherty, is a race of *aegeus*, a species distributed over the whole of New Guinea and its satellite islands, the Bismarck Islands, and from Queensland to Victoria. The ♀ is sometimes polymorphic. To the two forms already known of *othello* we now add a third. This form represents a type of *aegeus* ♀ already known from the neighbouring island of Mefor and from New Guinea.

The ♂ exhibited is remarkable for the yellowish tint on the hind-wing. This occurs to a much less extent in two other specimens. A well-marked case of this phenomenon in the race, *ormenus*, was made the subject of a separate species by Grose-Smith. Dr. Jordan points out in " Seitz " that a specimen of *P. ambrax* possessing a similarly coloured band, was received in the same collection as Grose-Smith's "*pandoxus*." We have received a number of *P. othello* and its three forms of ♀; previous to this only one ♂ and two ♀♀ were known.

P. euchenor is a typically Papuan species, also occurring in the Bismarck Archipelago. The race now described from Biak shows more relationship to *depilis* from the Bismarck Islands.

P. felixi is a distinct species belonging to the *Macareus*-group of Papilios. It is more nearly related to *leucadion* from the Moluccas than to the New Guinea forms of this group.

Pieridae.

The collection made by Doherty contained one *Delias*, which was described by Grose-Smith as *euphemia*. We now add six others. Half of these have affinity with Moluccan forms, and half with New Guinea forms. The *Delias euphemia*, of which we received a long series, is transitional from the New Guinea *mysis* to *bagoë* of the Bismarck Islands. This number of distinct *Delias* inhabiting Biak is another illustration of what has been observed in New Guinea, viz. the plasticity of members of this genus, leading to the production of distinct forms in nearly every small and isolated area.

Appias albina is a common species distributed from India to the Moluccas and Philippines, according to observations already recorded. We have received it from the Arfak Mountains, its occurrence in New Guinea not having been previously detected. The most easterly point of its range is Biak, and from here we have a long series. This represents a distinct race. The ♀ is polychromatic, and five forms occur in Biak. It does not appear that any of these differ from the forms already known from other parts of the species' range.

Appias ada is the Moluccan and Papuan representative of the species *lyncida*, which ranges from India to Celebes. *Appias ada* is distributed over the Moluccas, New Guinea and its islands, the Bismarck Islands, Solomons, Marianne and Caroline Islands. We now add a race from Biak to the fifteen already enumerated.

Pareronia chinki is a very distinct form of the genus and allied to *jobaea*. This species is represented in the S. Moluccas, Obi, Waigeu, N.-W. Dutch New Guinea, and possibly on the Key Islands.

Two species of *Elodina* were received from Biak. One of these agrees with *andropia*, Butl., from New Guinea. The other more nearly resembles *umbratica* from the Solomons, but is distinct, though perhaps a race of it.

Euploeinae.

Euploea tripunctata is a distinct form allied to *lacon* from N. Britain, and unlike anything from New Guinea or the Moluccas.

Euploea incerta is also distinct, though in appearance much resembling *obscura* and *cerberus* from the Bismarck Islands. It is more nearly allied to *obscura*.

Euploea albicosta is a curious species which is difficult to place, and we can find no near ally.

Nymphalidae.

Cynthia arsinoë ranges over the Moluccas, New Guinea and its satellite islands, Queensland, and the Bismarck and Solomon Islands. The Biak race seems nearer to *rebeli* from the New Guinea mainland.

Cethosia chrysippe ranges from the Moluccas to the Trobriand Islands. In "Seitz" Fruhstorfer enumerates twenty-one geographical forms. We now add a race from Biak.

Symbrenthia hippoclus is a common species distributed from India to New Britain and represented by thirty-five forms. The Biak form is nearest *hylaeus* from Dutch New Guinea.

Mynes aureodiscus is apparently a race of the species *geoffroyi*, which occurs over New Guinea, Queensland, and Aru Islands. This species is dimorphic in both sexes, the other form being black on the hind-wing below. This dark form was received together with the yellow form, but we can find no difference between it and *doryca* from Dutch New Guinea. The form here described resembles *semperi* from Queensland.

Charaxes latona is found in the Sulla Islands, N. Moluccas, Aru Islands, New Guinea and satellite islands, and Bismarck Islands. The very distinct Biak form is only represented by a single ♀ specimen. It approximates to *diana* described by Rothschild from New Hanover.

Hypolimnas pithoeka occurs in New Guinea, the Bismarck Islands, and the Solomons. The Biak form is sufficiently distinct.

The widely distributed *Doleschallia bisaltide* is represented on Biak by a dark form.

Doleschallia noorna is confined to New Guinea and a few adjacent islands. A sufficiently distinct race inhabits Biak and does not differ in the neighbouring island of Mefor.

Neptis shepherdi occurs in Queensland, New Guinea, Aru Islands, Waigeu, Obi, and Sulla Islands. The Biak form, which we call *greyalis*, is nearest *damia* from (late) German New Guinea.

The common *Neptis venilia* is represented on Biak by a sufficiently distinct form. A very similar form occurs in Dutch New Guinea and on the islands in Geelvink Bay, but is not noticed by Fruhstorfer in his treatment of the genus in "Seitz."

Euthalia aeropus is found in the Sulla Islands, the Moluccas, New Guinea and satellite islands, and Bismarck Islands. The Biak race is more like the New Guinea form. The ♀ is polymorphic, but we have only received the brown form.

Prothoë australis ranges over New Guinea and adjacent islands. A very distinct form was received from Biak.

Satyridae.

Elymnias cybele is distributed from the Moluccas to the Bismarck Archipelago. The Biak form is most nearly allied to *holofernes* from the Bismarck Islands.

In *Elymnias cinereomargo* we have a distinct form of *viridescens* which has only as yet been found at Humboldt Bay, and on the Sattelberg in (late) German New Guinea.

Melanitis amabilis ranges from the Moluccas to the Bismarck Islands. We have only ♀♀ from Biak, but these are slightly different from the typical form in the Bismarck Islands.

Heterocera.

Asota intermedia.

The collection contained but few moths. One is distinctly new to the genus *Asota* of the family *Hypsidae*. It differs from all other known forms in having a black lateral stripe on the second joint of palpus. It is a sort of *mixtum compositum*, blending the characters of two species.

Geographical Races of Cocytia durvillei, etc.—The Honble. Walter Rothschild, F.R.S., exhibited a series of the four geographical races of *Cocytia durvillei*, Boisd., and *Eucocytia meeki*, Rothsch. and Jord. He remarked that Sir George Hampson considered these insects to constitute a special family, *Cocytiadae*, which he placed between the *Lymantriadae* and the *Hypsidae*. But Mr. Rothschild considered them as a subfamily of the *Noctuidae*, which should be placed after the *Mominae*. The following is a synopsis of the group :—

Cocytianae.

Cocytia durvillei f. *durvillei*, Boisd., New Guinea;
Cocytia durvillei f. *veitchi*, Rothsch., Batjan and Halmaheira;
Cocytia durvillei f. *aurantiaca*, Rothsch., Timor Laut Islands;
Cocytia durvillei f. *chlorosoma*, Butl., with ab. *ribbei*, Druce, Aru Islands;
Eucocytia meeki, Rothsch. and Jord., New Guinea.

Mr. Rothschild also exhibited a species of *Papilio* (*Troides*) recently described by himself as *Troides allottei* (Novit. Zool. vol. xxi. p. 275, July 1914) from Bougainville. This insect is remarkable as combining the characters of the *victoriae* and *priamus* sections of *Troides*.

Paper.

The following paper was read :—

" New Butterflies and a Moth from Biak," by J. J. Joicey, F.L.S., F.E.S., and A. Noakes, F.E.S.

Wednesday, March 3rd, 1915.

Mr. G. T. Bethune-Baker, F.L.S., F.Z.S., Vice-President, in the Chair.

Election of Fellow.

Prof. Wm. Blaxland Benham, M.A., D.Sc., F.R.S., University of Otago, Dunedin, New Zealand, was elected a Fellow of the Society.

Exhibition.

Brenthis pales and arsilache from Norway.—Mr. P. A. Buxton exhibited a short series of *B. pales* and *B. arsilache* from Lesjevaerk and Surendal, Central Norway, the former having been taken at an altitude of 3000 to 4000 ft., the latter from 1000 to 3000 ft., where the two forms certainly overlapped. He said that without expressing any view on the specific identity or otherwise of the two insects it was interesting to note that Mr. Wheeler, to whom he had submitted them, had separated them without reference to the locality labels, which had confirmed his opinion. *B. pales* had not occurred above 4000 ft., whether in consequence of the climate, or of the absence of the food-plants at a higher elevation, he was unable to say. Two of the *pales* were very small, and while one was, as is often the case with very small

specimens, unusually dark, the other, which was much rubbed, had apparently never had any black marks on the upper side.

The Rev. G. Wheeler observed that he was quite satisfied that in Central Europe the species were distinct, as not only their wing-markings, but their habits, habitats and time of appearance were different, *arsilache*, for instance, being confined to marsh-land and appearing nearly a fortnight later than *pales*.

Mr. Sheldon said that in the Hohe Tatra they appeared about the same time, as he had taken *B. arsilache* at 3000 ft. and *pales* from 6000 to 7000 ft. within a day or two, the actual dates being July 7th for *pales*, and July 5th and 10th for *arsilache*, in each case newly emerged ♂ ♂ only being obtained. He also observed that while the two forms seemed to be sufficiently distinct in Southern Scandinavia, yet in the North and in Lapland all forms were mixed together and there was no dividing line. The question depended on what is a species.

Mr. Wheeler in reply said that, as he understood it, a species consisted of individuals that paired freely in nature, and that it was quite possible that *B. pales* and *B. arsilache* were still one species in the far North (probably their ancestral home), but had become distinct where they were kept apart either by altitude or different times of appearance. He added that *arsilache* was a fortnight later where the two forms overlapped in the Engadine, but that with 3000 ft. between them in altitude their time of appearance would probably be the same.

Mr. A. H. Jones corroborated Mr. Wheeler's statements with regard to the time of appearance and difference of habitat in the Engadine.

Dr. Jordan said that to add to the confusion, Esper had figured *arsilache* and called it *pales*.

Gynandromorphous Lepidoptera.—Dr. Cockayne exhibited :—

(1) Gynandromorphous *Agriades coridon*, from Royston, Aug. 1914. The specimen was predominantly female, var. *semisyngrapha*, the wings on the left side being smaller than

those on the right, and having additional blue scales with male hair scales and androconia on the small side.

(2) Gynandromorphous hybrid *harrisoni* (*Ithysia zonaria* ♂ × *Lycia hirtaria* ♀), bred in April 1912, by Mr. Worsley-Wood. The specimen resembled a female of this hybrid, but the left antenna was pectinated as in the male, the right was simple. He observed that Harrison stated that he had only bred one gynandromorphous specimen amongst several thousand primary hybrid *Bistoninae*, but that all the secondary hybrids were gynandromorphous. Standfuss also only bred two gynandromorphs amongst 4000 primary hybrid Saturnias, but many secondary hybrids were gynandromorphous.

Sicilian Species of Euchloë.—Mr. J. Platt Barrett exhibited a series of *E. damone* from Mt. Etna, and commented on their lack of variation. Also a series of *E. cardamines* var. *turritis*, remarking on their small size, the ♂ ♂ expanding $1\frac{1}{8}$–$1\frac{1}{4}$ in. and the ♀ ♀ from $1\frac{1}{4}$ in.

Mr. Bethune-Baker said that the small size of Sicilian var. *turritis* must be a local condition, as he had often taken this form quite as large as ordinary *cardamines*.

Noteworthy British Rhopalocera.—Comm. Walker, on behalf of Mr. Adams, exhibited :—

(*a*) A magnificent series of aberrations of *Polygonia c-album*, including several strongly suffused examples, from the Forest of Dean.

(*b*) Two specimens of *Araschnia levana*, gen. aest. *prorsa*, from the same locality, taken in 1914.

(*c*) A gynandromorphous *Urbicola comma*, right side ♀, left side ♂, from Box Hill.

(*d*) A very fine melanic aberration of *Dryas paphia* ♀, from S. Wales, taken by Mr. Rodney Wood.

Diptera from the Falkland Islands.—Mr. F. W. Edwards exhibited two species of apterous Diptera, one belonging to the *Borboridae*, the other to the *Ephydridae*, both collected in the Falkland Islands by Dr. Malcolm Cameron, Fleet Surgeon of H.M.S. *Cornwall*, on Dec. 7, the day before the naval battle. Both appeared to be new to science, and probably represented new genera. A number of other wingless or semi-wingless flies belonging to different families had

already been recorded from the Falklands, Kerguelen, and other subantarctic islands.

Mr. G. C. Champion observed that one of the beetles taken at that time in the Falklands was known from Kerguelen.

A Hybernating Pupa of Pyrameis atalanta.—Mr. L. W. Newman exhibited a living pupa of *P. atalanta*, and read the following notes on the copulation of *Pyrameis atalanta* in October, and the hybernating of the species in the pupal stage :—

Early in September I captured ten *Pyrameis atalanta* (some of both sexes) and placed them in a cage for laying. This they refused to do. On Oct. 7 I started my hot-house to force some *Manduca atropos* pupae, and brought the cage with *P. atalanta* into this house and placed it over the hot-water pipes. The heat in this house varies from 60° to 80°, seldom the latter.

The imagines were kept well fed, and on passing the cage on Oct. 12 I noticed a pair *in cop.* This was at 2.15 p.m., and they parted at 4.30; the temperature at 2.15 in the house was 75°, and I noticed it was not sunny. I believe little is known of the pairing of this species.

I supplied the fertile ♀ with nettle, and she laid freely on the 13th and 14th, I then took the nettle away as I wanted to try the experiment of keeping a known fertile ♀ alive till the spring. She was very unhappy for a few days without food to lay on, but by Oct. 22 she had settled down and was feeding regularly like her companions.

All went well with my ten specimens, and all were alive in early January, when I had to go into hospital for an operation. On my return home at the end of the month I was greatly disappointed to find that my specimens had not been fed, and my fertile ♀ was dead; this has ruined a very interesting experiment.

The ova, which were laid on Oct. 13 and 14, hatched from Oct. 28 to Nov. 1; larvae were fed up in a warm temperature and grew rapidly, the first to pupate being on Nov. 27 and the last on Dec. 3.

Immediately the pupae were firm enough to handle they were removed from the heat, and at once placed in my pupa

house on the concrete floor in metal boxes. Pupae kept in this house are usually a week later in emerging in the spring than the normal, as they get the frost but no sun, and the concrete floor is 3 ft. below the surface of the ground.

I obtained some 40 fine pupae, and as all are now alive (March 1) and show no signs of forming up I think I may claim that I have proved that *P. atalanta* can pass the winter in the pupal stage.

This discovery appears of great importance, and to me seems to throw a new light on the life-history of this common butterfly in England.

As many of you know, I have proved to my own satisfaction, but not to some others, that *P. atalanta* cannot pass the winter in England as an imago. I have for the past 10 years experimented with the species, and the only way in which I can carry it successfully through the winter is by feeding it regularly. I grant several records are to hand of the imago being found alive in January and February, among them are the records of my friend Mr. Walter Barnes, and his observations are thoroughly to be relied upon; but this finding of an odd specimen or two over long periods of years does not prove to me that the species can hybernate in England, there is no record that these January and February specimens live till April or May and pair and carry on the race. We all know that in mild autumns and winters we can find wild larvae and pupae in November and December, and we usually bring these into a warm room and breed out the imagines in December or January. Now why should not these found specimens be very late natural emergences? Say January ones, and that being the case they would live for a few weeks without food, tucked securely away among creepers or ivy, but would die off before the spring. We have many of us seen or captured in April or early May absolutely perfect specimens which look as if just out of the pupae, and we have wondered how they can look thus if they are hybernated specimens or immigrants. My discovery that the species can pass the winter in the pupal stage seems to clear up the mystery of these fresh spring specimens.

I wish it clearly understood that I am still of the opinion

that we are almost entirely dependent on immigration for our supply of *P. atalanta*.

Comm. WALKER said that at Gibraltar this species was almost continuous-brooded, and suggested that some of the winter specimens found in Britain might be immigrants blown over by prevailing south winds.

Mr. MERRIFIELD observed that in his temperature experiments he had never been able to keep pupae of *P. atalanta* alive for more than 10 or 11 weeks, either out of doors, or at a temperature of 33, and later of 50 degrees and upwards.

A LARGE FAMILY OF ACRAEA ENCEDON, L., BRED AT DURBAN FROM A KNOWN FEMALE PARENT.—Prof. POULTON exhibited a portion of this family kindly sent to him by Mr. E. E. PLATT, who had conducted the experiment.

The female parent, of the *encedon* type form, was taken on Mar. 8, 1914. One batch of ova was laid under a leaf of *Commelina* on the following day, and another batch on Mar. 10, after which the female parent unfortunately escaped. The larvae commenced hatching, Mar. 17. The brood being somewhat unmanageable, about 220 half-grown larvae were liberated. The first pupation took place on April 15, and the dates of emergence from pupae produced by the larvae reared in captivity were as follows :—

1914.	*Encedon.* ♂	*Encedon.* ♀	*Sganzini.* ♂	*Sganzini.* ♀
April 23	—	—	2	—
,, 25	6	—	4	—
,, 26	4	—	2	—
,, 27	28	—	12	—
,, 28	23	3	13	—
,, 29	9	10	9	8
,, 30	15	8	6	7
May 1	6	10	4	5
,, 2	2	10	1	8
,, 3	1	—	—	3
,, 4	1	1	—	—
,, 5	—	—	1	1
,, 6	—	2	—	—
,, 10	—	—	—	1
,, 12	—	—	—	1
,, 15	—	—	—	1
Totals	95	44	54	35

The early emergence of the males and their great numerical preponderance over the females, 149 to 79, were very obvious

in the above list. This great disproportion between the sexes rendered it probable that all-female families of *encedon* would be found in Natal; for Mr. Lamborn had found that these families in the Lagos district were compensated by families in which the males were more numerous (Journ. Linn. Soc., Zool., xxxii, 1914, p. 400).

Judging by the 52 specimens exhibited to the meeting, the whole of the 228 offspring were sharply divided into the two forms that were commonest in Natal—(1) *encedon*, generally with a bright fulvous ground-colour, occasionally darker and approaching *infuscata*, Auriv., the females with white, the males with yellow subapical bar to the fore-wing; (2) forms resembling the dusky yellow variety of the white *lycia*, F., named *sganzini* by Boisduval; the females much paler and therefore nearer to *lycia*, F., than the males. The Mendelian relationship, although probable, was not very clear in the proportions—139 *encedon*, to 89 *sganzini*. There was little doubt, from Mr. Lamborn's experiments, that, in the Lagos district, *encedon* was dominant and *lycia* recessive. It was therefore likely that the same relationship held in Natal, *lycia* being represented by the yellowish *sganzini*. If this were so, it was probable that the female parent was a heterozygote which had mated with a recessive (*sganzini*) male, and that the results are to be explained as a very imperfect approach to equality. More breeding experiments were needed in Natal, to test the Mendelian relationship and the existence of all-female families.

Although the two forms segregated so completely there was marked individual variation in both of them. This was especially well seen in area 2 of the fore-wing in the great majority of the examples of *encedon*, both male and female. Here a triangular white spot was developed on the outer (distal) side of the black spot that is a characteristic feature of this area. A beautifully gradual transition was manifest in both sexes, passing from maximum development to entire disappearance of this white spot; and a similar gradation was seen in the *sganzini* forms in which, however, the feature was far less striking, because in these the spot was of the same tint as the ground-colour of the wing.

The gregarious habit during Hibernation of Musca corvina, F.—Prof. Poulton described the hibernation of vast numbers of *M. corvina* in the cistern-loft of St. Helens Cottage, St. Helens, Isle of Wight. When he arrived at St. Helens on Jan. 4, 1915, it was found that a most unpleasant smell was emitted by the low-pressure water-supply, both hot and cold. He investigated the loft on Jan. 5 and found several patches of flies on the close boarding of the roof. The angle between a rafter and the boarding was nearly always selected as a resting-place where the flies were crowded, touching each other, so as to form long narrow black patches. Part of one small patch was resting on the floor, the remainder passing out of sight over the edge of the floor-boarding. Each of the largest assemblages must have included many hundreds of individuals. Many dead mould-covered flies were floating in the two coupled cisterns, while far larger numbers were lying thickly spread over the bottom. One cistern, which happened to stand beneath the most crowded part of the roof was far more affected and smelt more strongly than the other. When the water was turned off and the cisterns emptied from the taps in the lower part of the house one ball-tap became choked with flies and had to be taken apart in order to clear the obstruction. The body of water affected was large, being $13\frac{3}{4}$ in. deep in both cisterns, the internal length and breadth of the most strongly affected 34 in. and 17 in., of the other $33\frac{1}{2}$ in. and $21\frac{3}{4}$ in. respectively. To this must be added the quantity of water in the pipes, the cylinder of the hot-water apparatus, and four flushing cisterns. A large sample of the semi-torpid flies was taken by the simple process of sweeping part of the roof with an ordinary housemaid's brush into a pail of hot water. It was observed that the great majority of the flies sank to the bottom a few hours after they had been killed by the heat. The sample after being dried was sent to Col. J. W. Yerbury, who very kindly determined and sexed the specimens exhibited to the meeting, viz. 304 males and 514 females, not including 23 specimens, mostly in very poor condition, which could not be determined with confidence. Mr. A. H. Hamm had kindly assisted in counting the specimens and arranging the exhibit. Col. Yerbury had agreed

that the larvae of the hybernating flies had probably bred in a large heap of decaying grass and weeds in the yard outside the part of the building with the cistern-loft in its roof.

The first statement (1878) of Müllerian Mimicry.—Prof. Poulton said that during a recent study of Fritz Müller's work he had come across an earlier statement than the classical paper "Ituna and Thyridia: a remarkable case of Mimicry in Butterflies," published in *Kosmos* (May 1879), translated by Prof. Meldola, F.R.S., and printed in the Proceedings of the Entomological Society of London for the same year (p. xx). This brief preliminary account of the hypothesis was of interest in many ways, and as it appeared to have escaped the attention of naturalists, Prof. Poulton thought that the Entomological Society would wish to publish the following translation kindly prepared by Mr. E. A. Elliott from the original in Zool. Anzeiger (Carus), I, (1878), pp. 54, 55 :—

On the advantages of Mimicry among Butterflies. By Fritz Müller, Itajahy, Brazil.

It is remarkable how one sometimes puzzles for years over questions the solution of which is so simple that one can hardly understand how there could have been even a momentary difficulty over them.

This was my experience in the matter of Mimicry among Lepidoptera. *Danainae, Ithomiinae, Acraeinae, Heliconinae*, all appear to be equally well protected by disagreeable smell and taste, and yet there are among them a number of mimicking species. The smell of the species of *Eueides* is especially strong, yet *Eueides pavana* is a mimic of *Acraea thalia*, *E. isabella* of *Helic. eucrate*, or *Mechanitis lysimnia*, and *E. aliphera* resembles *Colaenis julia*, except in size. What advantage can it be to a creature protected by repellant odour to resemble another similarly protected species? If their foes avoid protected species by "instinct," none at all; but if, on the contrary, as appears so much more probable, the foes have to learn their unpalatability by experience, then the benefit is all the greater, the less numerous the species. The advantage gained by two unpalatable species by their resemblance is in inverse ratio to the square of their numbers.

Instead of a general, really very simple, deduction, let us take an example.

There are in a certain district two unpalatable species, the one numbering 10,000 individuals, the other 2000. If the foes inhabiting the same district destroy annually 1200 individuals of an unpalatable species before learning to avoid it, this number would be lost by each species if they were different; but if they were so similar that the experience with one serves for the other, then the first would lose 1000, the other 200 individuals; the first would thus gain 200, or 2 per cent. of its total strength, and the second 1000, or 50 per cent. of its total. This consideration shows further, that in all probability in many cases (e. g. *Thyridia* and *Ituna*) the question which of the two species is Model, and which is Mimic, is idle: each has reaped some advantage from being like the other; they may even have gone to meet each other.

The following paper was read as a basis for a discussion on Mimicry:—

The Mimetic Theory—"A Crucial Test," by Colonel N. Manders, F.Z.S., F.E.S.—The publication of three papers* on the subject of Mimicry by Dr. Hale Carpenter in our Transactions for 1913, brings this subject once more prominently forward, and his whole-hearted enthusiasm as a supporter of it must have given much satisfaction to those who hold the same views as himself. Those, however, who like myself have never been able to accept the theory, but who at the same time admire the persistence and energy with which it is constantly brought to our notice in spite of the many rebuffs it has lately received, have read with mixed feelings Dr. Carpenter's papers. Personally I have nothing but admiration for the amount of most valuable work he has done at odd moments snatched from his official duties, the skill with which he has marshalled his facts, and the courage of his interpretation of them expressed in almost the last paragraph of his first paper (p. 616): "If, as I believe, this explanation be the correct

* *Pseudacraea eurytus hobleyi*, Neave, its form and its models on Bugalla Island, Lake Victoria, with other members of the same combination. By G. D. Hale Carpenter, D.M. Oxon, Member of the Royal Society's Sleeping-sickness Commission.
This is the only paper I deal with.

one, it supplies the strongest possible proof of the reality of mimicry and of the power of natural selection to produce it—indeed, it is a crucial test."

To pass over this challenge in silence would convey the wholly false impression that his arguments are unanswerable, and that Müllerian Mimicry is at last firmly established on its pedestal. I therefore propose to examine closely this " crucial test," and shall show that far from being conclusive of mimicry it affords the " strongest possible proof " of its inherent unsoundness.

Though our Society rightly refuses to open its pages to controversy, yet when an opportunity arises for settling once for all by means of scientific investigations the validity or otherwise of a theory which has been before us in one form or other for over half a century, and which has obtained a world-wide celebrity, such opportunity should not be lost.

The crucial test Dr. Carpenter brings forward is briefly as follows : — Immediately off the north-west coast of the Victoria Nyanza lies a small archipelago known as the Sesse Islands, the largest of which is Bugalla, distant from the mainland near Entebbe about twenty-five miles.

The nearest of the Sesse Islands is, I believe, within sight of the mainland.

On Bugalla and also on Damba Island to the N.E. of the Sesse group, the species *Pseudacraea eurytus* f. *hobleyi* is abundant, and shows great diversity of marking, so much so that many of the varieties have received distinctive names and are regarded as transitional forms resembling the genus *Planema*. For some reason, probably the absence of the food-plant, *Planema* is distinctly rare on the island, though very abundant in the neighbourhood of Entebbe on the mainland, where also *Pseudacraea* occurs equally commonly; but (and this is the important point) transitional forms are absent or very rare. (Whether *Pseudacraea* is regarded as an edible genus or not, is not stated, and for our purpose is immaterial.)

The argument to account for the absence of these transitional forms is best given in Dr. Carpenter's own words.

" Now on the Island it is quite conceivable that an enemy of the *Pseudacraea* might never see *Planema* at all : at any

rate the latter are so extremely scarce that they can have little protective value, and the *Pseudacraea* would gain little by resembling models that are less common than itself. Consequently any form of *Pseudacraea* that is produced will have as much chance of surviving as the most perfect mimic, and the transitional forms appear almost as abundantly as the types. On the mainland, however, conditions are very different. Owing to the abundance of Planemas, their presence is of definite protective value to the Pseudacraeas, and varieties that are produced which do not conform rigidly to the types of the models are put at a disadvantage in the struggle for existence, and *are destroyed by enemies in preference to the types. On the mainland the mimics are kept rigidly up to the mark* [italics mine], and the transitional varieties between *hobleyi*, *tirikensis* and *terra* are by comparison rarely to be found. It may perhaps be argued that there is some condition productive of greater variability on the island, but not on the mainland. But though intermediate varieties are scarce on the mainland, yet they *do* occur, and it is difficult not to believe that they are rarely caught by collectors, because they are so much more destroyed by enemies than are those which more closely resemble models. If, as I believe, this explanation be the correct one, it supplies the strongest possible proof of the reality of mimicry and the power of natural selection to preserve it—indeed, it is a crucial test."

Inasmuch as the localities where these insects occur are unfamiliar to the majority of English entomologists, let me transfer the case to the British Islands.

Let the county of Sussex distant from the mainland twenty-five miles represent Bugalla Island; the Isle of Wight would be connected with France by a chain of small islands stretching across the Channel, but in place of a sea subject for half the year to the storms of winter we have a warm equable climate such as exists under the equator.

In Sussex we have a butterfly, let us say *Melitaea aurinia*, occurring in great abundance, and in its many forms familiar to all of us, some of them more or less resembling another butterfly *Hamearis lucina*, which for some cause not quite clear is very scarce. On the other side of the Channel at Calais

both butterflies are equally common, but those forms of *Melitaea aurinia*, which do not resemble *Hamearis lucina* are rare or absent, the reason being that they are exterminated by insectivorous birds. It is to be noted that the birds on either side of the Channel are of the same species, and that the passage of the Channel to a bird of ordinary powers of flight is only a matter of a couple of hours.

We are now in a position to understand more clearly the state of affairs on the Victoria Nyanza.

What proof does Dr. Carpenter bring forward for his statement which I have put in italics? None whatever! It is a form of argument familiarly known as begging the question, and in itself is sufficient to condemn the theory, but, as I shall show later, the whole theory of mimicry is founded on this species of argument.

Prof. Poulton, on what evidence I know not, has stated his belief that each young bird during its tasting experiments only tastes a few of each unpalatable species in its neighbourhood; this being so, the bird population on the mainland must be very considerable to produce such an effect, and there should not be any great difficulty in making a sufficient number of observations; but it is curious that Dr. Wiggins, a keen entomologist, and one who has resided at Entebbe for some years, knows nothing about it.

Now the bird population on the mainland and on Bugalla is practically the same, and it cannot be seriously contested that what takes place on the one does not take place on the other, and Dr. Carpenter must agree with me that if it can be shown that the birds on Bugalla do not eat butterflies it is proof positive that they do not eat them on the mainland twenty miles away, and therefore there is no thinning out of transition forms; that their absence is not due to natural selection, and that his case of mimicry falls to the ground.

Is this evidence forthcoming? is it trustworthy? and from whom?

I think it will come as a matter of as great a surprise to other Fellows as it did to me when I say it comes from Dr. Carpenter himself! I must confess that I am amazed that neither he nor Prof. Poulton, who supervised his paper, did not realise

what a weapon they were putting in the hands of an opponent by not attempting some explanation of the fact, let alone not referring to it, that in the one hundred and sixteen birds shot and examined on Damba and Bugalla Islands no portion of a butterfly was found!

As these dissections of Dr. Carpenter are probably not known to entomologists, being contained in the "Reports of the Sleeping-sickness Commission of the Royal Society," it is advisable to make some comments on them.*

The birds were shot in every month of the year except from May to August inclusive, so that incidentally there should have been some evidence of tasting experiments, but there were none, and we may assume that none took place as the younger being less experienced would be more easily shot, and the larger proportion of those examined would be in their first or second year. They comprised flycatchers (six species), bee-eaters (three species), warblers, a chat, shrikes, bronze-green cuckoos, insectivorous kingfishers, weaver-birds and a stone-curlew.

Unfortunately in the first fifty-two birds shot, Dr. Carpenter, who was searching more particularly for evidence of tsetse-flies, gives no details of the contents of these birds' stomachs; but he says of twenty-six bee-eaters the contents were mostly Hymenoptera and dragon-flies, and of the other birds, king-fishers, etc., no information except that no tsetse-flies were found.

The remaining sixty-four were more carefully examined—fifty-three by the naked eye, and the remainder by a low-power microscope. In the first fifty-two birds there *may* have been remains of butterflies, but if we judge by the remaining sixty-four it is highly improbable that there were.

The bee-eaters mostly fed on bees and dragon-flies, the aposematic crimson and blue bodies of the latter evidently affording them no protection! In the other birds mention is made of "very small insects," "indistinguishable minute insects," "winged ants," "two large Hymenoptera," "grass-hoppers," etc., etc., and in one flycatcher "a single large

* Reports of the Sleeping-sickness Commission of the Royal Society, No. XII, p. 90; No. XIV, pp. 15, 16.

Noctuid moth about two inches in expanse." It is obvious, therefore, that if butterflies formed any portion of these birds' food except the smallest they would have been detected.

Now what holds good for Bugalla must also hold good for the country twenty miles away, and so by Dr. Carpenter's own showing the birds on the mainland do not eat butterflies, and he has no justification for his words which I have placed in italics.

There is not a particle of evidence, therefore, to show that the absence of intermediates is due to natural selection, but strong evidence that it is not.

A theory may be regarded as reasonably true or used as a good working hypothesis, even if there is little or no direct evidence of the truth of its premises, if it fits in with the results of observation and experiment, and until evidence to the contrary is forthcoming; when this is produced it should be discarded.

The theory both of Bates and particularly that of Müller rests mainly on two unproved but reasonable propositions: that certain genera of butterflies are distasteful, and that young birds undertake tasting experiments. If sufficient evidence has been published to disprove both propositions or to throw reasonable doubt on them, it is clearly the duty of the supporters of the theory to lay it aside until they have disproved or explained the rebutting evidence. But Mimicrists do not do this; they ignore or pay but slight heed to adverse evidence and pursue their way apparently oblivious of it.

Theoretical deductions from so-called instances of mimicry do not advance their views, but rather converts neutrality into active hostility.

We may inquire what direct evidence of distastefulness and tasting experiments has been brought forward by supporters of these theories who have resided in Africa, and who have published papers similar to those of Dr. Carpenter.

From East Africa the Rev. St. Aubyn Rogers, who has spent some years in that part of the country, has brought none. Dr. Lamborn, a most acute observer on the West Coast, none, or less than half a dozen instances of distastefulness.

In South Africa, Mr. Marshall fourteen observations in

eleven years or *vice versa*. In Central Africa Mr. Neave gives a single instance in which a bird selected certain *Lycaenidae* in preference to Acraeines. There may be a few others, but if so I am unaware of them. I believe I am substantially correct in stating that the direct evidence for distastefulness on this continent depends upon Mr. Neave's water-wagtail. Dr. Carpenter inadvertently gives the explanation why the wagtail avoided the Acraeines in his remark that these birds only eat small insects. Of instances of tasting experiments there are none. All this bears out the remark made by Mr. Frederick Selous, that during the twenty years he was in Africa he never saw a bird eat a butterfly.

On the other hand in India, with the exception of one observation by Col. Bingham, there is much evidence to show that far from being inedible the so-called nauseous butterflies are more largely eaten than others, and any butterfly mimicking them is courting disaster by so doing.

Mr. Andrewes in the Nilgiris and myself on their eastern slopes noticed the ground strewn with the wings of Danaines and Euploeas in the close vicinity of drongos and flycatchers. In Ceylon Col. Yerbury has seen Euploeas being eaten by the ashy wood-swallow. Mr. Fryer has recorded a flock of the same bird feeding on them for days. Mr. Poole also records a fly-catcher eating large numbers of a so-called inedible Pierine.

Further, Mr. Andrewes has watched bulbuls feeding their young on Acraeines, and I have recorded the same with a fly-catcher and *Euploea*. Further evidence could easily be quoted.

No observations or evidence of any kind, as far as I know, have ever been furnished regarding the tasting experiments of young birds in a wild state except my own, in which I clearly showed that in one species nothing of the kind takes place. I do not go so far as to say that the instances I have given are sufficient in themselves to disprove the mimetic theory, but, coupled with the failure of Dr. Carpenter's crucial test, we shall not go far astray if we conclude, before bringing forward other crucial tests, to first ponder the words of J. Henri Fabre, Darwin's " incomparable observer " :—

" The Mimicry of the Bumble-bee fly [resemblance of *Volucella* to *Vespa*], which was said to be one of the most con-

clusive cases, is, after all, a mere childish notion. Patient observation, continuously face to face with facts, will have none of it and leaves it to the arm-chair naturalists, who are too prone to look at the animal world through the illusive mists of theory."

I do not myself consider in the present state of our knowledge that it is wise to bring forward " crucial tests."

There are too many factors involved, the influence of which is very obscure and which make any " test " extremely risky. We are quite unable to say in any one instance how much is due to natural selection, Mendelism, climate, environment and the like, and until further investigation and experiment is undertaken it is advisable only to put on record the facts and the conclusions which may be legitimately deduced from them. The whole subject of mimicry, occupying as it has done some of the best intellects, entomological and other, since the time of Darwin, cannot be accepted or dismissed in consequence of one or even a few crucial tests, it is far too complicated a subject for such summary treatment, and if I have written at all strongly it is with a view to impressing upon the more ardent supporters of mimicry the urgent necessity of examining their subject from all points of view, and not from that standpoint which is particularly attractive to them.

Prof. Poulton said that he wished to protest mildly against Col. Manders' unqualified statement that the theories of mimicry were " constantly brought to notice." They had only been brought before the Society when there were new facts to record. Nor could he accept the implication conveyed in Col. Manders' reference to the " many rebuffs . . . lately received." That more work was wanted he freely admitted and had admitted for many years, but it would not be doing justice to English naturalists in Africa if their successful efforts to throw light on the question were passed over as of little account. The whole subject had been *immensely* advanced by the researches of the past twenty years.

Col. Manders had rather seemed to single out Müllerian Mimicry, as though his contentions were specially directed at

this hypothesis. This was not so; Col. Manders' position, if sustained, would affect Batesian no less than Müllerian Mimicry. One controversy was enough at a time, and to emphasise one hypothesis as Col. Manders had done was to run the risks of obscuring the main issue.

The essential argument of Col. Manders' paper was concerned with birds and butterflies, and Prof. Poulton proposed to leave this in the able hands of Mr. C. F. M. Swynnerton, who had done so much along this very line of work, and whose conclusions, already briefly stated in "The Ibis" and in the Memoirs of the Second International Entomological Congress (1912), were not even mentioned by Col. Manders. It was very fortunate that we had Mr. Swynnerton with us to speak in this discussion, although every Fellow present would regret the absence of Col. Manders and of Dr. G. D. H. Carpenter.

Col. Manders, referring to insects found by Dr. Carpenter in the stomachs of birds, had spoken of "the aposematic crimson and blue bodies of the latter (dragon-flies) evidently affording them no protection." The term "aposematic" carried with it the implication of conspicuousness and display: it involved an investigation into the relationship between colour, movement, and attitude, and Prof. Poulton did not believe that such an inquiry would support the suggestion that the bright tints of dragon-flies were warning colours.

Another good example of Col. Manders' reasoning was seen in his treatment of Mr. S. A. Neave's observations on a wagtail which rejected an *Acraea*. "These birds only eat small insects," he wrote, as if he had disposed of the whole matter, without stopping to inquire whether the *Acraea* was large or small or what relation its size bore to that of the *Terias* which was eaten by the bird. Nor did Col. Manders refer to the fact that the *Acraea* in being rejected received disabling injuries similar to those which were commonly exhibited by specially protected species.

It was unnecessary to repeat the discussion following Mr. Fryer's observations on the attacks by *Artamus fuscus* on Danaine butterflies in Ceylon, but it would be remembered that much attention was paid these most valuable records, although, for the reasons given, but now passed over by Col.

Manders, it was not admitted that the theories of mimicry had been weakened. That great literary genius and wonderful observer Henri Fabre, who found the " Origin of Species " too dull to read and yet was continually holding up to ridicule what he supposed from his inner consciousness must be Darwin's views, had attacked one interpretation of mimicry in the Volucellas, but had not troubled to mention the other.

Col. Manders had summed up the possible causes of mimicry as " natural selection, Mendelism, climate, environment and the like." Mendelism was a relationship in heredity, and manifestly did not account for the origin of the forms which exhibited such relationship; " climate, environment and the like " produced effects which very few now believed to be capable of hereditary transmission. Therefore, if, as Col. Manders argued, natural selection also failed, the innumerable examples of mimicry remained without an interpretation.

A most important reply was made by Mr. C. F. M. Swynnerton, which he has embodied in the following paper :—

A Brief Preliminary Statement of a few of the Results of Five Years' Special Testing of the Theories of Mimicry.

A. *Introductory.*

At the instigation of Mr. G. A. K. Marshall, my immense indebtedness to whom and to Prof. Poulton for endless help and encouragement I have stated more fully in one of my larger papers, I attempted, by a long and very careful series of experiments and special observations that extended from late 1908 to late 1913, to test the truth of the theories of mimicry and of the various objections that have been brought against them. I have since been continuously engaged in preparing a detailed account of this work for publication. Seeing, however, that the question of the validity of mimicry is announced for full discussion at this meeting of the Society, seeing too that much of the actual experimental evidence is in any case now ready for publication, it seemed a pity that some indication of its trend should not be available for

the purposes of this discussion, much as I should have preferred to keep even this until the experimental evidence had seen the light.

The experiments.—Difficulties and likely causes of error (at first mainly suggested by Mr. Marshall's critical brain) were taken severely in hand from the very outset, while further complicating factors were noted and duly guarded against for the future as they came to light. Experiments on captive birds were checked by a series of observations and experiments on wild ones. It was realised that results obtained from a few offerings or even a few dozen experiments could hardly be regarded as entirely trustworthy, and, in the main experiments alone, probably not far short of 17,000 butterflies were offered from first to last to the various animals employed, as well as much prey of other orders. The refusals and rejections, duly given a value by the eating immediately afterwards of other species, or by the knowledge that the animal was hungry, and frequently confirmed by re-offering and *re*-offering, must alone have run into a few thousands.

I mention all this simply to indicate that the work was attemptedly thorough and probably reliable, and that the brevity of some of the statements I am about to make should not be taken as a measure of the evidence on which they are based.

B. *Bearing of results on certain objections to the Selectionist view.*

Alleged indiscriminateness; discrepancies between treatment of same prey by wild birds and tame.—(1) Unless through sheer impossible hardness, size, etc., there is practically no such thing as "inedibility." In the early morning, or after the ejection of a pellet, a bird may quite readily eat *Acraeinae* or even *Danainae*. As it fills up somewhat it refuses such very low-grade prey, but still eats other species, which in turn it rejects when slightly fuller—and so to repletion-point.

In view of this it is unsafe to deduce either "palatability" or "indiscriminateness" from an acceptance—including the finding of an insect in a wild bird's stomach or "unpalata-

bility" from a rejection, in cases where the state of the bird's hunger at the time of the incident is unknown. A bird will often accept eagerly a low-grade species when hungry enough, or reject a favourite species when replete.

The statement sufficiently explains many of the cases in which individual birds of a species (perhaps caged) have been seen to refuse what others (perhaps wild) have been known to eat, and *vice versa*.

(2) A bird, given a definite choice, either fails to exercise it, as between the things he is hungry enough for, and merely takes each as it comes, or, when he does exercise it, tends to select the largest object that he is at the moment hungry enough to eat; *e. g.* an *Amauris niavius* may then be taken in preference to a *Precis cebrene*. This accounts for much that has seemed difficult, as in Colonel Manders' experiments and my own earlier ones in which "nauseous" butterflies were taken in apparent preference to pleasanter ones.

The fact remains that my various birds (with the exception of one probably specialised species—the ashy wood-swallow may well be another) would only eat *Amauris* when hungry, but *P. cebrene* nearly to repletion-point. That the advantage may be a great one, sufficient to make the possessor worth mimicking, is shown by the immense meals that are sometimes eaten after the refusal of a low-grade butterfly; *e. g.* forty butterflies including fourteen large *Charaxes* by a roller after she had rejected a *Mylothris*, and thirty-seven including twelve large *Charaxes* after her rejection of a *Terias*.

All I need add here is that *all* the very varied animals on which I was able to test the point showed marked preferences, eagerly eating some species of prey when nothing would induce them to eat other species, and that the preferences of my captive birds were confirmed by wild birds and by each other.

Other objections.—No one, I believe, who has closely and continuously and frequently watched the "searching" species that in tropical countries form so large a proportion of the bird-population, as they climb in parties over the trunks and twigs, peer into every cranny and inspect each surface of each leaf, pull off or prise aside small loose scraps

of bark and scrutinise the underlying surface, or has seen the closeness with which birds will sometimes examine an insect that they are hesitating to attack or (occasionally) one that they have just rejected, or the way in which some birds will try inanimate objects that they are not quite sure about, will continue to retain an implicit trust in the argument of "*Hypertely.*" And no one who has frankly noted and analysed, day after day, his own hesitations and mistakes (many of them quite ridiculous), whether due to an imperfect view, the play of light and shadow, lack of recent acquaintance, insufficiently concentrated attention or attention concentrated too late—and a mere splash of colour or trick of flight in common—and has seen (as I have) similar hesitations on the part of birds, will doubt the value—incomplete, but very real—of *incipient resemblances.* As for *instinctive knowledge of food-values,* special experiments on several of my birds have produced the same results as those of Prof. Lloyd Morgan, and I have seen even wild birds test and reject inanimate objects. A special experiment on a young eagle (*Aquila wahlbergi*) showed that, unstarved, it would eat vegetable substances (including, once, raw green peas and a tuberous *Plectranthus* resembling Jerusalem artichoke) as readily as meat, even picking them up from the ground for itself, until (as seemed to be rather clearly shown) it learnt which food was, very definitely, disagreeing with it.

The eating of butterflies by birds.—I have myself seen far more numerous attacks on insects of other orders, and watched dipteron-eaters that were being kept busy by their favourite prey consistently ignoring butterflies; and in my days of superficial stomach-examination I found butterfly remains in only five stomachs out of more than a thousand. American stomach-examinations are said to have produced only five cases out of 50,000. I am therefore unable to regard it as a matter for surprise that those to whom mimicry does not appeal should have been sceptical about the eating of butterflies by birds.

" Neglect of well-directed and sustained observation " (Mr. Trimen), frequent removal of wings and the likelihood " that attacks will in general be made only under specially favour-

able conditions, such as, when the butterfly passes very close to the bird's perch, or when the attention of the insect is distracted during feeding, courting, ovipositing, etc."—these were Mr. Marshall's main suggestions in explanation of the paucity of evidence (Trans. Ent. Soc. Sept. 20, 1909), and he gave over 670 records of actual attacks, many of them multiple, drawn from various sources. His striking illustrations—of English kestrel and garden-warbler, familiar birds not known to eat butterflies, yet now observed preying on them systematically—and, more lately, my own results, seem rather to bear out the first of these suggestions; wings too very often *are* removed (though also frequently swallowed), and the head is sometimes rejected, and the butterfly by some birds eaten piecemeal—and the truth of Mr. Marshall's last suggestion I can bear out from actual observation. It is a point of great importance.

Another very important consideration, which I suggested in " The Ibis " for October 1912, is that in localities or seasons in which, as at Chirinda, the butterfly population is very small indeed relatively to that of other orders, we cannot reasonably expect to see anything approaching as many attacks on butterflies as on these other insects. Both this view and Marshall's (that birds probably accept easy chances) are borne out by the fact that when, temporarily and locally, I have removed the disparity in population by definitely releasing a number of butterflies to birds, and when I have given them the easy chances by placing disabled butterflies in their way, I have many times witnessed more or less numerous attacks. One such experiment elicited as many as sixty attacks by eight species of birds in what could have been little over half an hour. " But if it is necessary to disable a butterfly to get it attacked you admit that butterflies are not attacked under natural circumstances." The objector here forgets that butterflies are not always flying zigzag at top speed, far from cover. Relatively easy opportunities such as Marshall suggests occur very frequently in nature—and I have seen some taken. But the fact that they entail the butterfly's presence in or within a few inches of cover immensely lessens our chances of seeing the attacks. During

the periods when the fine *Vernonia podocoma* bushes that line portions of the Chirinda Forest outskirts are attracting numbers of butterflies they become greatly frequented by certain birds also, and, watching from a little distance, one often sees a sudden sharp movement at the back of a flower-head or the quick dash of a bird over the top of a panicle on which butterflies and Hymenoptera may be feeding together. But it is seldom possible to see which prey is taken. Yet each time I have searched the foot of the bushes I have found freshly broken butterfly-wings. A case in which a green bulbul, that I would certainly not have seen had I not been looking at that very point, appeared momentarily (from behind) between outer leaves on which butterflies were basking, seized one of them and as quietly withdrew, is highly instructive.

This all applies to the small closely-searching birds that form the very great bulk of our insectivorous bird-population. There are other birds that do *not* attack (necessarily) under cover, such as drongos, paradise and spotted flycatchers and bee-eaters, but tackle the butterfly they are hungry enough for on the wing, and if necessary pursue him. We tend to see rather more numerous attacks on the part of such birds as these, and one reason why we do not see still more is probably to be found in the fact that the butterfly, if not captured right away, very commonly at once goes to ground and is no longer available. As Prof. Kathariner (observation stated by Marshall, *ibid.*, p. 350) wrote of an attack by a flock of bee-eaters on *Thais cerisyi* that was " flying in great numbers " : " In the shortest space of time there was not a butterfly to be seen. Those that were not eaten had hidden under the herbage." I am able to confirm this observation as to the general result on the pleasanter butterflies of the arrival of a flock of bee-eaters. Naturally unless one is present at that arrival one sees few or no attacks on such butterflies. I know nothing of the behaviour of *migrating* butterflies in relation to these birds.

Migratory locusts do not go to ground in this wholesale manner; neither are *Danainae* and *Acraeinae* (as I have seen in relation to bee-eaters) as easily frightened as the higher-

grade butterflies, though individuals *may* drop in response to an actual attack. This, with their relative ease of capture, is probably the reason why attacks on Danaines, as on the locusts, are relatively often witnessed—even by birds that have to be hungry before they will attack them. Where, however, a bird that is specialised to prey on them is seen in the midst of insects that thus tend to keep on the wing, we may well expect the striking and interesting but potentially misleading observation of wholesale attack on nauseous models that Mr. Fryer has actually recorded.

Where, in such cases as I have referred to, I myself replaced the pleasanter forms that had gone to ground by releasing appropriate substitutes—usually here, be it noted, unmaimed and thoroughly active and strong-flying individuals—I usually at once secured instances of attack. In one case some of the birds even came and hovered a few feet over my head, like gulls in the wake of a ship, in eager competition for the next butterfly that should go up.

I witnessed in all during those five years well over eight hundred attacks by wild birds on butterflies—four hundred of them, it is true, by a shrike, the preferences of which I made a point of ascertaining in detail. The immense majority of these attacks were seen within a single month, during which I experimented on the wild birds of the forest outskirts for an hour or two each day, and the attackers included our four commonest bush-shrikes, our three commonest grass-warblers, our commonest bush-warbler, three out of our four most abundant bulbuls (one of them the commonest insectivorous bird in the country, another by far the commonest bird in the forest), our three commonest *Saxicolidae*, including both our common robins, and our five commonest flycatchers. Other attacks were by *Ploceidae*, a pipit, sun-birds, a butcher-bird, drongos of our two common species, a cuckoo-shrike, swallows, a night-jar, bee-eaters, a roller, a common hornbill, also unconfined but tame ground-hornbills, two genera of insectivorous kingfishers and a ground-cuckoo. Naturally there were refusals as well, and these with the rejections gave me some clear idea of the birds' preferences; but I saw numerous cases of eagerness as striking as the one I have quoted above, and

the experiments left in me the irresistible conviction that our birds at Chirinda are anything but specially reluctant to prey on butterflies. And I know at present of no reason why the birds of Chirinda should be different in this respect from the birds of all those localities in which the evidence is as scanty to-day as it was at Chirinda until I specially tested the point.

There were further lines of evidence too. Newly captured birds, where tested, showed in their refusals and acceptances a good previous knowledge of their butterflies; and damage to butterflies' wings that was quite indistinguishable (as my exhibit to-night most convincingly shows) from the common form of damage one sometimes finds in nearly every fairly high-grade butterfly one meets, and that occurs in butterflies collected all over the world, was actually seen inflicted on a number of occasions by both wild birds and tame. Moreover, on my painting conspicuous eyespots on the under surface of more than fifty large butterflies (*Charaxes*) that used to come to feed at the bananas in my verandah, out of 47 injuries subsequently sustained by the wings, 36 were at or just beside eyespots, and 25 of these affected *both* of a pair of wings. "Accidental damage" fails to fit the case. Nor does it sufficiently meet the case (with which I have many times met) in which *abdomen* and wing are correspondingly wounded. It is hard, too, to believe that the beautiful impressions of a bird's bill that occasionally accompany or replace wing wounds in the butterflies we capture, and that occurred too in the wet paint of some of the butterflies of the just-described experiment, have been placed there, as used to be believed of fossils, merely to tempt us to error!

With all this very convincing direct and indirect testimony the striking lack of evidence hitherto afforded by stomach-examination is very difficult to reconcile—at any rate, the result of the great American examinations, in which the microscope was, I imagine, freely used. Having regard to relative population, we cannot expect to find more than occasional butterflies in stomachs, but five out of 50,000 is not even "occasional." My own lack of evidence—and

that, I expect, of most field-naturalists *—is more intelligible, seeing that the examination was by the naked eye and superficial, and that I have since found, both experimentally and by careful examination of pellets with known contents, that butterfly-chitin, including the wings, tends (though less so in *Danainae* and, I believe, *Acraeinae*) to break up under the influence of digestion into minute fragments that, seen by the naked eye, would probably usually be classed as "indistinguishable insect débris"; I *have* on occasion gone through whole pellets of nothing but butterfly remains without finding anything that would have readily indicated the presence of *any* butterfly to the unaided eye: while the chitin of even the smallest beetles and grasshoppers (also the wings of Diptera) eaten with the butterflies, breaks into larger fragments if at all, and commonly remains very recognisable even in the pellets and excreta. This view, as to at any rate one possible reason for my own failure, seems to be supported by my finding scanty Lepidopterous débris in three or four of the very few stomachs that I have so far had time to re-examine as I now consider they should be examined. This, I may say, is a very slow process, entailing the inspection where necessary of the very last particle of mere dust in the stomach. It is emphatically not the kind of work over which the man who is searching specially for insects of economic interest or even for nameable material generally would, or could be expected to, spend his time. This is Mr. Marshall's belief too, and he has done much stomach work of this very kind. It may be conceivably one explanation of the lack of evidence.

I conclude with the interesting case of the twenty droppings of small birds that I picked up quite at random in the Chirinda Forest at a moment when, amongst other butterflies, a big brood of *Mycalesis campina* was out. Eighteen of them—or 90 per cent.—showed Lepidopterous débris, much of it indistinguishable in colour of membrane and appearance of sockets, scales, etc., from *Mycalesis*, but distinct from

* Dr. Carpenter examined only 11 stomachs microscopically—too small a number to be conclusive, especially if he did not state whether pleasanter butterflies were available in such relative numbers at the time as to have been really likely to have been in the stomachs.

the forest moths which I captured and compared with it. If actually of butterfly origin it would suggest, once more, that when butterflies are sufficiently available birds may even find it worth while to turn their special attention to them—as Mr. H. C. Bryant has actually noted in California in connection with the butterfly *Eugonia californica*.

I propose to deal with the whole question of birds and butterflies far more fully in a future paper—after, I hope, further stomach-examination work.

The Bugalla Island case.—Col. Manders has objected to Dr. Carpenter's suggestion as regards the greater frequency in Bugalla of the transitional forms of a *Pseudacraea* which there considerably outnumbers its *Planema* model, that Bugalla Island is near enough to the mainland (where the proportions are reversed) for birds to pass freely to and fro. The solution to this question of bird-habits is, curiously, provided by Bates himself in his very fascinating description of the hunting-habits of the birds of Ega (" The Naturalist on the Amazons," vol. ii, pp. 334–6 of the 1863 edition). I have myself, year in and year out, noticed the same phenomenon in our African birds. It is that the great mixed parties of insectivorous birds that systematically and in combination search the woodlands for their prey, each have a definite limited area that they keep to and " drive " thus day after day. There are two such main parties, each with its special " beat," in that portion of the Chirinda Forest in which I chiefly collect (I distinguish them from each other by the presence of certain constant component members), and my experience fully coincides with Bates' where he remarks: " I became in course of time so accustomed to this habit of birds in the woods near Ega, that I could generally find the flock of associated marauders whenever I wanted it. There appeared to be only one of these flocks in each small district."

If birds by choice thus confine themselves to a given area of forest—up to 200 acres to a flock is my estimate for Chirinda, though a small isolated forest-patch of perhaps forty acres separated from Chirinda by only a few hundred yards of grassy hill-side boasts a flock of its own—will they not, *a fortiori*, tend on the whole to keep within such islands

as Bugalla and Damba, large in area and the latter separated by twenty-five miles from the mainland? And even if a certain amount of interchange *should* take place (as is likely), or the mainly local birds that form the island parties be reinforced for a few months in the year by migratory species (as they will), will not the new arrivals very rapidly discover (as the result of a fact I have referred to under "Alleged indiscriminateness") that the "Planemas" they attack when hungry enough for *Acraeinae* are in this place mostly Pseudacraeas and acceptable therefore (to rely on my experimental results with *P. lucretia* and *P. trimeni*) right away up to *Neptis*-refusing point?

In relation to any bird that has made this discovery the fact that it wears the livery of a *Planema* will no longer be of the full use to a Bugalla *Pseudacraea* that it probably was to those of the mainland, and the very interesting phenomenon described by Dr. Carpenter might be expected to come about in the course of time, other things being equal, if the Selectionist view be correct. I fully endorse Col. Manders' warning as to the necessity for watchfulness in respect of the possible occurrence of complicating or alternative factors.

Replying to the question, "*Are birds deceived by resemblances in their prey?*" I may say that I have tested this in very numerous and varied experiments, and that the answer is in the affirmative. I have some evidence even in the case of wild birds. As for the *experimental tastings of young birds*, I have obtained plenty of evidence that a vastly *more* powerful potential factor is at work.

The visual memory of birds proved to be inadequate to the task it has to perform, and constant mistaken attacks followed by rejection were found to take place—though less so, on the whole, in relation to prey that had been frequently and recently experienced. It appeared that no bird could be too old or too experienced to make continual mistakes of this kind.

The factor was shown to be probably an extraordinarily powerful one and far more than capable, from this point of view, of replacing that suggested by Fritz Müller. In fact, it is doubtful whether the experimental tastings of young birds contribute, *relatively* speaking, specially heavily towards

it, seeing that most insectivorous birds are throughout that stage under the direct tuition of their parents—a tuition that I have seen exercised even towards a bird that must have been nearly a year old (dissuasion from eating a *Danaida*). The new factor entails a new formula: for Müller's virtual "Whatever its population the same number of experimental attacks for each homœochrome," we must substitute "The greater the homœochromatic population the fewer mistaken attacks" (other things being equal); it being a matter of memory and practice. It gives us an excellent contributory basis for mimicry, and the basis, too, for an altered conception of synaposematism. I am holding over, for inclusion in another paper, my statement as to the exact bearing of my results on the actual questions of mimicry and synaposematism, as these do not fall within the scope of the present discussion.

Meantime, if it is accurate to say that a theory may be regarded as reasonably true if it fits in with the results of observation and experiment, I cannot help feeling that the general theory of mimicry now nearly meets the requirement. The main thing still lacking as I write, is the confirmation from stomach investigation of the otherwise well-indicated fact (though similar evidence by other observers and from other localities is highly desirable) that birds are not reluctant to eat butterflies.

The Rev. G. Wheeler said that although he was not in agreement with Col. Manders on the subject of mimicry, yet, as the paper had been put into his hands, he felt that he ought to point out that what Col. Manders had specially objected to was treating any test that had yet been applied as "crucial." He said that most Fellows were probably aware that Dr. Carpenter had a very enthusiastic way of expressing himself, and had probably said more than he meant, in which case he added that he could entirely sympathize with him.

Prof. Poulton remarked that of course the expression "a crucial test" should not be taken too literally.

Mr. Neave said that much of Col. Manders' argument depended on his assumption that what was true of the

bird-population on the mainland must also be true of that on the islands. He had never been on these particular islands himself, though he had visited some of the neighbouring ones, but according to his experience in Africa this was most unlikely to be the case.

Mr. G. A. K. Marshall and Dr. Jordan commented on the great importance of Mr. Swynnerton's observations and experiments.

Wednesday, March 17th, 1915.

The Honble. N. C. Rothschild, M.A., F.L.S., F.Z.S., President, in the Chair.

Exhibitions.

A Sikkim Asilid with a large Delias as prey.—Prof. Poulton exhibited a female *Promachus*, of a species unnamed in the British Museum, captured with its prey, a male *Delias descombesi*, Boisd., 7.30 a.m., Aug. 18, 1914, at Takdah (5000 ft.), Sikkim, by Major T. D. Broughton, R.E. It appeared remarkable that the fly should have been able to hold an insect with so great an expanse of wing; but Mr. C. F. M. Swynnerton had even found that far more powerful butterflies, of the genus *Charaxes*, were killed by Asilids at Chirinda, S.E. Rhodesia. It was intended to exhibit these latter on some future occasion.

A note on the African Hesperid butterfly Ploetzia cerymica, Hew.—Prof. Poulton exhibited the specimen referred to in the following note written Dec. 26, 1914, by Dr. G. D. H. Carpenter, from Kakindu, in German East Africa, 1° S., about 30 miles W. of the Victoria Nyanza and 500 ft. above it.

" I send you a skipper of much interest. It came to light one night [Dec. 23] about 9 p.m., and behaved much like a moth. The feature of interest is the large white patch on the antenna, which at once reminded me of the white antennae of the male *Baoris niveicornis*, Plötz [Proc. Ent. Soc.

Lond., 1913, p. xcv.]. You will be interested to hear that the white patches were *extremely* conspicuous and really *glistened* in the light almost as if they were phosphorescent. I was able to catch the specimen in my fingers. It is the first time I have seen it, and the first skipper I have seen come to light."

Prof. Poulton said that the species was usually diurnal. A male specimen in the Hope Department had been captured at 9 a.m. in the clearing of Oni Camp, Nov. 5, 1910, by Mr. W. A. Lamborn. Mr. J. A. de Gaye had noted concerning a male (Feb., 1912) and female (Jan. 21, 1912) that they had the habit of settling on walls in the grounds of King's College, Lagos. These two latter specimens were exhibited to the meeting, together with a male (Oct. 4, 1910) and female (Sept. 24, 1910) captured by Rev. K. St. Aubyn Rogers at Rabai near Mombasa. These specimens showed that the brilliant patch on the antenna was characteristic of the male. It was probable that the shorter duller patch of the female had originated by the transference, in a reduced form, of a male character. It would be of much interest to investigate the courtship of this species, and attempt to decide whether the brilliant antennal patches possessed epigamic significance. A positive conclusion, if well founded, might throw some light on the difficult problem of insect vision.

Scarce Varieties of Zonosoma pendularia.—Comm. J. J. Walker exhibited, on behalf of Mr. F. C. Woodforde, bred specimens of *Zonosoma pendularia*, L., var. *subroseata*, Woodforde, and var. *subochreata*, Woodforde, with the type-form of the species for comparison. Both forms were supposed to be confined to North Staffordshire.

Dr. Cockayne observed that var. *subroseata* had also been taken in Lincolnshire.

Organs in Ants' Antennae.—Mr. W. C. Crawley exhibited drawings in various species of ants, of two kinds of organs in the funiculi of antennae, one kind called by Forel "champagne-cork" organs, the other "interior tube" organs, or "bottle" organs. They are often, if not always, in the living insects, filled with air, and may possibly be connected with the sense of hearing.

He also exhibited the following drawings of genital armatures of ♂ ants, viz. :—

Lasius niger, *Myrmica scabrinodis*, *M. scabrinodis* var. *sabuleti*, *M. ruginodis*, *M. laevinodis*, and *M. sulcinodis*. The only one of the *Myrmica* group to show any marked difference is *M. sulcinodis*, where the stipes is longer and the volsella dilated at the end of the curved portion. Those of *M. ruginodis* and *M. laevinodis* are very similar, and differ from that of *M. scabrinodis* by the greater width of the lobe of the volsella. *M. scabrinodis* and var. *sabuleti* are almost exactly alike. The armature does not appear to be of much value for specific differences in these ants, and a drawback to its use in general is the difficulty of obtaining ♂ ♂ with the ♀ ♀.

Teratological Specimens of Coleoptera. — Mr. H. Willoughby Ellis exhibited a male specimen of *Carabus nemoralis*, Mull., which is also interesting as a variety, being much smaller than typical specimens and the interstices of the elytra being more rugose and raised into bar-like forms somewhat as in *Carabus monilis*, F., var. *consitus*, Pz. The specimen was taken at Braemar, May 7, 1912. Teratologically the right posterior leg is little more than half the size of the left one, though the parts in themselves are quite proportionate, the femur and tibia being quite perfect on the smaller scale; the tarsus, which is also proportionate, has the 4th joint truncate at the base, making it much shorter, and is soldered to the 5th joint which is rather broadened. The terminal claw is thicker, blacker and blunter than the others.

He also exhibited a specimen of the dark variety of *Campylus linearis*, L., taken at Knowle, Warwickshire, in June 1899. It is of the usual size and, with the exception of the thoracic foveae being more exaggerated and the right intermediate tarsus being very remarkable, is normal in all respects. This tarsus consists of (1) a complete tarsus normal in all respects, (2) a second tarsus thickened in all the joints up to the 4th, from which springs a pair of 5th joints of normal size, both being terminated by a perfect claw, (3) another growth, presumably an embryo tarsus, has started out from the centre of the tibia. These give the appearance of quite a sheaf of tarsi.

An Imported Bruchus.—Mr. Champion exhibited, on behalf of Mr. W. West of Greenwich, specimens of *Bruchus chinensis*, L. (*pectinicornis*, L.), found in lentils in a London warehouse, also a male found at large at Dartford.

Nuptial Flight of Butterflies.—Dr. F. A. Dixey made the following communication :—

" At the Meeting of the Entomological Society of London held on Nov. 4, 1914, a discussion took place on the part taken by the male and female respectively in the nuptial flight of butterflies (see Proc. Ent. Soc. Lond., 1914, pp. xcviii and c). As at that date I had not returned from abroad, I was unable to take part in the discussion. But it has since occurred to me that it might be of some interest if I were to put on record the notes of some observations made by me on this point; especially as I am able to give the exact time and place at which the observations were made.

" To begin with *Polyommatus icarus*.

" (1) Mortehoe, North Devon; Aug. 11, 1898. A paired ♂ and ♀ were seen flying and settled several times. The ♂ was undoubtedly supporting the ♀, which latter seemed passive.

" (2) Mortehoe; Aug. 16, 1898. Nuptial flight; the ♂ undoubtedly supporting the ♀.

" On *Argynnis adippe* I have the following note—

" (3) Tubney Wood, Berks. A ♂ in flight supporting a passive ♀.

" Of *Epinephele jurtina* I have several records—

" (4) Mortehoe; Aug. 24, 1894. A ♀ observed carrying a ♂.

" (5) Mortehoe; July 12, 1897. A ♀ undoubtedly supporting a ♂, which was passive.

" (6) Mortehoe; July 20, 1897. A ♀ supporting a ♂.

" (7) Mortehoe; Aug. 9, 1897. A ♀ carrying a ♂. The ♀ was in fair condition, the ♂ worn.

" (8) Woolstone, Berks; June 29, 1901. A ♀ in flight supported a ♂, which was passive. When settled, the ♀ was uppermost with head up, the ♂ was head downwards.

" A note on *Satyrus semele* says—

" (9) Mortehoe; July 13, 1897. A ♀ undoubtedly carried a ♂, which was passive.

" So far my observations are in accord with Mr. Wheeler's, except with regard to *Argynnis adippe*, of which species, however, I have only one record. But when we come to the Pierines, I must admit a discrepancy. My first note relates to *Pieris napi*—

" (10) Mortehoe; July 15, 1897. A ♂ was certainly supporting a ♀.

" Next, of *Pieris rapae*—

" (11) Mortehoe; Aug. 14, 1898. Here again a ♂ in flight supported a ♀.

" Then of *Pieris brassicae*—

" (12) Highcliff, Hants; Aug. 3, 1904. A ♂ carrying a ♀. The ♂ active, the ♀ passive. When settled, the ♂ rested with head up, the ♀ with head down.

" Finally, I have three observations on Pierines in South Africa. The first two relate to *Belenois severina*—

" (13) Durban, Natal; Aug. 17, 1905. A ♂ supporting a ♀ in flight.

" (14) Sydenham, near Durban; Aug. 21, 1905. Again a ♂ carrying a ♀.

" The third is a note on *Pinacopteryx pigea*—

" (15) Durban; Aug. 20, 1905. A ♂ supporting a ♀ in flight, and when settled enclosing the ♀ between his wings.

" I have only to add that these notes were all made at the time, and not from recollection."

Wednesday, April 7th, 1915.

Dr. G. B. Longstaff, M.A., M.D., Vice-President, in the Chair.

Vote of Sympathy.

At the unanimous request of the Council, the Chairman proposed that a letter should be written to the President on behalf of the Society, offering condolences on the sudden death of his father, the late Lord Rothschild; the resolution

was unanimously passed, the whole meeting rising in their places.

Election of Fellows.

Mr. William Carr, B.Sc., Station Road, Bentham, Lancaster, and Dr. A. Eland Shaw, Samarai, British New Guinea, were elected Fellows of the Society.

Exhibitions.

Algerian Rhopalocera.—The Rev. G. Wheeler exhibited a box of Algerian butterflies, of species treated of by Mons. Ch. Oberthür in the recently published fascicule x. of his "Lépidoptérologie Comparée"; most of the specimens shown had been given to the exhibitor by Mons. Oberthür, and many of the species were exhibited for the first time in England.

The following is the list of species exhibited (the nomenclature of the "Lépidoptérologie Comparée" being given in parentheses):—*Pontia* (*Pieris*) *daplidice*, L., gen. aest. *albidice*, Obth.; *Euchloë* (*Anthocharis*) *belia*, L. [*eupheno*, auct.]; *Anthocharis pechi*, Staud.; *A. crameri*, Butl. [*belia*, auct.]; *A. falloui*, Alld.; *A. belemia*, Esp., and var. *glauce*, Hb.; *Calicharis nouna*, Lucas, *Gonepteryx cleopatra*, L., *Eugonia* (*Vanessa*) *polychloros*, L., var. *erythromelas*, Aust.; *Dryas* (*Argynnis*) *pandora*, Esp.; *D.* (*A.*) *paphia*, L., and var. *dives*, Obth.; *A. auresiana*, Fruh.; *Satyrus ellena*, Obth.; *S. powelli*, Obth.; *S. sylvicola*, Aust.; *S. fidia*, L., var. *albovenosa*, Aust.; *S. abdelkader*, Pier.; *S. lambessanus*, Staud.; *Hipparchia* (*S.*) *prieuri*, Pier.; *H.* (*S.*) *semele*, L., var. *algirica*, Obth.; *Coenonympha fettigii*, Obth.; *Melanargia lucasi*, Ramb.; *Bithys* (*Zephyrus*) *quercûs*, L., var. *iberica*, Staud.; *Thestor mauretanicus*, Lucas; *Cigaritis zohra*, Donz., and var. *jugurtha*, Obth.; *Plebeius* (*Lycaena*) *martini*, Alld.; *Aricia* (*L.*) *medon*, Rott. (*agestis*, W. V.) ab. *ornata*, Staud.; *Agriades* (*L.*) *bellargus*, Rott.; *Scolitantides* (*L.*) *abencerragus*, Pier.; *S.* (*L.*) *fatma*, Obth.; *Urbicola* (*Augiades*) *benuncas*, Obth.; *Hesperia* (*Syrichthus*) *numida*, Obth.; *H.* (*S.*) *onopordi*, Ramb.

New Goliath Beetle.—Mr. O. E. Janson exhibited a

new species of *Coelorrhina* (family *Cetoniidae*) in which the cephalic male armature usual in this genus was entirely absent, and to which he had given the name *mutica*.

Variety of Palomena prasina.—Mr. H. Willoughby Ellis exhibited a British variety of the Pentatomid bug *Palomena prasina*, L., differing from the type in its larger size and dark olive colour. Taken on ivy at Torquay, May 25, 1907.

North American Papilios.—Mr. E. B. Ashby exhibited the following species :—

Papilio turnus, "the Tiger Swallowtail," one of the most beautiful insects of the Carolinian Fauna. The species is dimorphic in the female in the southern portions of the territory which it occupies. In Canada and northwards the dark dimorphic female does not occur.

Papilio rutulus, which closely resembles *P. turnus*, but the female of which is never dimorphic. It is the representative on the Pacific coast of its eastern congener, the common Tiger Swallowtail.

Papilio eurymedon, which ranges from Mexico to Alaska and eastwards as far as Colorado. It is very common in the cañon of the Fraser River in British Columbia in the month of June.

Papilio troilus, "the Spice-bush Swallowtail," which occurs throughout the Atlantic states, and the Mississippi Valley.

Papilio asterias, the common eastern Swallowtail, a species subject to great variation, especially in the female, which occurs throughout the Atlantic states and in the Mississippi Valley.

Papilio brevicauda, "the Newfoundland Swallowtail," of which there are two varieties, one with yellow spots on the upperside of the hind-wings, more or less deeply marked, which occurs quite commonly on the Island of Anticosti, the other (not exhibited) with orange-yellow markings, which is abundant in Newfoundland.

Genital Armature of the Male Ant.—Mr. H. St. J. Donisthorpe showed the accompanying chart of the names applied to the genital armature of male ants, and read the following notes :—

"As there does not appear to be a complete or clear account of the genital armature of the male ant in the English language, and as there seems to be considerable difference of opinion among Hymenopterists as to what the parts which make up the genitalia are called, and in what way they are connected with each other, I thought it might be useful if I made a few remarks on the subject, treating it from both an anatomical and a historical point of view.

"To illustrate these remarks I have prepared a chart, some rough sketches, and some dissections.

"As to the terminology, I agree with our secretary, my friend Mr. Wheeler, that one should not be tied down by the laws of priority as in nomenclature, but on the other hand one should not invent, or use, new names for the different parts without any sufficient reason, as this only adds to the difficulties of the unfortunate student in the future. Neither should one accept the attempted reforms of others nor adopt any names, or any particular author's terminology, until a study of the subject has been made and it is seen that the author in question has good reasons for his views.

"The following is the terminology adopted by me in my book on the British ants which I hope will be published shortly.

"The *Annular Lamina* is the basal ring which lies in front of the other appendages, and is situated under the 9th dor. seg.

"The *External Paramera* consist of the outer and intermediate pairs of appendages.

"The outer pair are the *Stipites* which act as claspers, and are often furnished with hairs. In some genera the upper parts of the stipites consist of semicircular plates, which are called the *Squamulae*. These look as if they were separate plates applied to the stipites, but this is not the case as they are actually part of them.

"The median pair are known as the *Volsellae*, these are sometimes more or less divided into two pairs, they then become the *Laciniae* and the *Volsellae*, but as pointed out by Emery in many species they are incapable of being distinguished.

"The *Volsellae* and *Laciniae* also probably act as claspers.

"The *Internal Paramera* consist of the innermost pair

	De Geer (1771.)	Latreille (1802.)	Dufour (1841.)	Nylander (1846.)	Mayr (1855.)	Schenck (1855.)	Thomson (1871.)	Forel (1874)	Verhöff (1893)	Perez (1894.)	Emery (1895.)	Janet (1902.)	Wheeler (1910.)
Annular Lamina	Anneau écailleux		Pièce basilaire				Cardo		Lamina annularis	Article basilaire	Lamina annularis	Cardo	Annular Lamina
External Paramera	Crochets								Äussern Parameren	Forceps	Paramera externa		External Paramera
Stipites		Tiges écaileuses	Branche du forceps	Vaginae externae	Aussere Klappen	Aussere Klappen	Stipites	Valvules externes			Stipites	Pinces	Stipites
Squamulae		Pièce en forme d'écaille semi-circulaire		Squamulae laterales	Halbkreise-formigen plattes	Halbkreisc-formigen Blättchen	Squamae	Écailles			Squamulae		
Volsellae		(Crochets)	Volselles	Vaginae intermediae	Mittlere Klappen	Mittlere Klappen		Valvules moyennes			Volsellae	Volselles	Volsellae
Laciniae			Truelles				Laciniae				Laciniae		Laciniae
Internal Paramera									Innern Parameren	Forcipule	Paramera interna	Lames du Pénis	Internal Paramera
Sagittae			Baguettes	Vaginae internae	Innere Klappen	Innere Klappen	Sagittae	Valvules internes			Innere Parameren		Inner Paramera (Penis)
Spatha			Fourreau				Spatha			Fourreau	Spatha		
Subgenital Lamina									Subgenitalplatte		Lamina subgenitalis		
Penicilli	"Barbillons"			Penicilli	Penicilli	Steilchen		Penicilli			Cerci	Penicilli	Penicilli

of appendages, the *Sagittae*, which are connected together by a membrane, the *Spatha*, and the Sagittae + the Spatha function as a penis.

"The Sagittae often have serrated edges which probably serve to hold them in position during copulation.

"The three pairs of appendages which make up the External and Internal Paramera enclose each other.

"The *Subgenital Lamina* is a plate situated beneath the genitalia, and consists of the 9th ventral segment of the abdomen. It is sometimes pointed, forked, or rounded, and presents valuable distinctive characters in some genera.

"Finally, we have a small pair of hairy appendages, the *Penicilli*, which are attached to the 10th dorsal segment of the abdomen. They are not present in some genera such as *Anergates*, *Dorylus*, etc., and in *Prenolepis* they are present in some species and wanting in others, and are consequently valuable for classification purposes.

"They are stated to represent the Cerci in *Blatta*, etc., but this does not seem to be absolutely certain."

Mr. Donisthorpe then described the structure of the abdomen in ants showing that the 9th and 10th dorsal segments in the ♂ were rudimentary and situated beneath the last visible abdominal segment—the pygidium, and that the last ventral segment was the 9th—the 10th being lost, and was situated beneath the 8th ventral segment—the hypopygium.

Mr. Donisthorpe then explained the Historical Chart. He pointed out that he had practically followed Prof. Emery, who had made a careful study of the whole subject in 1895. Although in the 1895 paper Emery refers to the sagittae as the "Innere Parameren," in his later works he uses the term "Sagittae."

Genital Armature of Aculeate Hymenoptera.—The Rev. F. D. Morice exhibited a series of Lantern-slides to show the structure of the ♂ genital armature and the ventral segments adjoining it in various groups of Aculeate Hymenoptera, and more particularly the characters exhibited by two of these segments (the 7th and 8th) in 35 Palaearctic species of the Genus *Hylaeus*, F. (*Prosopis* of Jurine and most recent authors).

Paper.

The following paper was read :—

" Hymenopterous Parasites bred from the Pupae of *Chortophila brassicae*, Bouché, and *Aeidia heraclei*, L.," by J. T. Wadsworth, Research Assistant, Dept. of Entomology, University of Manchester; communicated by Dr. A. D. Imms, D.Sc., B.A., F.L.S., F.E.S.

Wednesday, May 5th, 1915.

The Honble. N. C. Rothschild, M.A., F.L.S., F.Z.S., President, in the Chair.

Exhibitions.

Living Pupae of Pyrameis atalanta.—Following on his exhibit and notes of March 3 last, Mr. Newman again exhibited these pupae, and said he thought he might now fairly claim to have proved that this species can pass the winter in England in this condition.

Mr. Bethune-Baker said that he had bred this species to the pupal stage in October, but had afterwards forced them.

In answer to an inquiry Mr. Newman said that he was still of opinion that we depended almost entirely on immigration for our supply of *P. atalanta*, but that fresh early specimens taken in this country were probably from pupae which had hibernated here at that stage.

The Amathusiid Genus Hyades, Boisd.—Mr. Talbot exhibited specimens of the genera *Hyades* and *Taenaris*, and read the following notes :—

The genus *Hyades* was founded by Boisduval on the species *bioculatus*, Guér., which has priority over *indra*, under which name it was described by Boisduval.

Stichel in the " Genera Insectorum " and Fruhstorfer in Seitz's " Macrolepidoptera " have both sunk *Hyades* under *Taenaris*. There is, however, a difference in structure between the forms of *bioculatus* and those of typical *Taenaris* which

is not noticed by the above authors. This difference may be tabulated as follows :—

Taenaris.	*Hyades.*
Forewing.	Forewing.
Cell short and broad; vein 3 nearer 4 than to 2; vein 5 from middle discocellular.	Cell long and narrow; vein 3 midway between 2 and 4; vein 5 amalgamated with lower discocellular and appearing as though proceeding from lower angle of cell near 4.
Hindwing.	Hindwing.
Vein 4 curved at end of cell.	Vein 4 slightly angled at end of cell.

I now submit that the genus *Hyades*, Bdv., should be re-established. It will comprise the species *bioculatus*, Guér., and its races *pallida*, Fruh., *charonides*, Stgr., *charon*, Stgr., and *charondas*, Fruh.

Stichel associates with these in his group of *Bioculatiformes* the species *gorgo*, Kirsch, *microps*, Gr.-Sm., *dimona*, Hew., and *dina*, Stgr., all typical *Taenaris*, whilst Fruhstorfer further includes in his "Hyades" section the species *horsfieldi*, Swains., *urania*, L., and *diana*, Butl.

It is very interesting to note that *Taenaris dina*, Stgr., and forms of *dimona*, Hew., closely resemble in pattern forms of *Hyades bioculatus*; how far we have here to do with a true case of mimicry must remain to be decided.

The two genera are closely related, and during their development have maintained the ancestral eye-spot pattern. That this pattern has some protective significance is shown by its being mimicked by the ♀♀ of certain *Satyridae*. It is therefore not surprising that though the *Hyades* forms differ in their structure from *Taenaris* forms, the pattern of the latter has been retained.

New Lepidoptera from the Arfak Mountains, Dutch New Guinea.—Mr. Talbot also exhibited on behalf of Mr. J. J. Joicey some new Lepidoptera from the Arfak Mountains,

Dutch New Guinea, including a local race of *Ornithoptera paradisea*, Stgr. He observed that this was the first record of a ♂ of this species from Dutch New Guinea. The form *flavescens*, Roths., from S.W. Dutch New Guinea was only known in the ♀, and this was similar to the typical form. The ♀ from the Arfak was most interesting as more resembling *meridionalis*, Roths.; 2 ♂♂ and 4 ♀♀ of this specialised form were obtained. Other specimens shown comprised a local race of *Danaida weiskei*, Roths., a *Platypthima*, an *Abisara*, two forms of *Dicallaneura*, five forms of *Diacrisia*, including one with an *Arctia*-like pattern quite unlike any other in this somewhat extended genus, two *Noctuidae*, one constituting a new genus, four *Lymantriadae*, a new genus of *Eupterotidae*, and both sexes of the curious Chalcosiid *Aglaope hemileuca*, Roths., hitherto only known in the ♂ from British New Guinea.

The Italian mode of exclusion of the House-fly.—The Rev. F. D. Morice drew attention to a paper in the Trans. Ent. Soc., vol. i (1836) by W. Spence on this subject, in which it was stated that flies were excluded even by large mesh netting over the windows, provided there was no through light, and to another paper by his son, W. B. Spence, on a passage in Herodotus in which he states that certain fishermen kept off mosquitoes by covering themselves with their fishing nets.

Mr. J. Platt Barrett said that he had found the system ineffectual in Sicily, but that it was possible that through light had been admitted.

Messrs. Rowland-Brown and Durrant also commented.

Further Notes on the habits of the African ant Megaponera foetens, F.—Prof. Poulton read the following account sent to him March 27, 1915, by Mr. C. O. Farquharson at Moor Plantation, Ibadan, S. Nigeria :—

"While I was living in the Agege district, some twelve miles north of Lagos, in the year 1912, I saw on one or two occasions what appeared to me to be an army of Stink Ants (*Paltothyreus tarsatus*, F.), which large species abounds there. They had evidently been on a foray, which had resulted in the rout of the enemy, the latter a species of Termite; for

every ant carried a victim, not infrequently much larger than itself, in the form of the large Termite soldier. The particular Termite soldier I knew to be a formidable fighter, for one has only to push a stick into the nest to have them rush out in force to meet the enemy. My respect for the Stink Ant, which till then had been very low, was not a little increased. There was rather a fine dignity about the progress of the small army, the members of which march three or four abreast, in a fairly open formation, each one about half an inch to an inch from its neighbour. The line, on each of the occasions on which I have seen it, extended for about fifteen feet. There would perhaps be about 500 individuals in all, at a rough estimate. The Stink Ant I had only known before in less-distinguished rôles. An unpleasant sight which I have witnessed several times, is to see these great ants cutting a large earthworm into inch lengths, which they carry to their nests. They are rather cowardly, and quickly run to cover when disturbed, although not before making their presence felt by emitting the disgusting odour which has earned them the expressive name by which they are known out here. The Termite raiders are a comparatively rare sight, and I thought no more of them till my next tour, when I had Dr. Lamborn for a colleague. He interested me in the subject of ants in general, and one day, in discussing some of the Ponerines here, the subject of the comparative rarity of the hunting-in-file habit among them cropped up, and I asked him if he had ever seen it among the Stink Ants at Oni; for they are not common up country. He had not, and, knowing far more of the matter than I did, asked me to take special note of it on the next occasion I saw it, and to get specimens.

"About the middle of August last year, just before going on leave, I was once more in the Agege district and had the good fortune again to see the raiders, on their return march. I followed them to their nest, which was under a tree root. The entrance was wide and irregular (about 2 inches in diameter), and might have been made by rain washing under the stump of the tree. The tree itself had been felled a year or two before, and in falling had doubtless lifted the root a little (without, however, tilting it up, for it had been a small

tree) so that there would be numerous loose cavities in the soil underneath. The only evidence of the presence of ants was the small heap of rubbish carried from the nest and dumped a small distance from the entrance. This consisted mainly of old cocoons and the remains of soldier Termites, with particles of soil, though the latter was only in small quantity and would appear to indicate that the inhabitants of the nest do very little in the way of excavation. (In the making of a Driver nest a large amount of earth is thrown up.)

" The small army soon disappeared underground. I managed to get a few members with their prey, and it was then that I knew definitely that they were not Stink Ants and noted for the first time their most striking character, the loud hissing they made when disturbed. Merely to stamp on the ground in their neighbourhood is enough to make *Paltothyreus* start for the nest, and the disgusting odour they emit soon assails the nostrils. This time, however, the effect was entirely different. The part of the line nearest the cause of the alarm, immediately spread in all directions, apparently eager to do battle, and, without any effort, I could hear quite distinctly their loud hissing, almost like water on hot metal. The line soon re-formed on my remaining quiet. I stooped over them to get a nearer view and made a few remarks to a friend who was standing by. As soon as I had spoken, though I was otherwise making no movement or noise, the ants nearest me broke from the ranks, and the whole army began to hiss. This little experiment I tried several times, and always with success. The comparative speed with which they cover the ground, and maintain their regular formation, though cumbered with the dead or paralysed foe, is very remarkable.

" I had by this time only a day or two left, but hoped with good luck to be able to trace them to a termitarium, if I found them setting out. Their nest was on the cultivated ground of a farm, a few yards from thick bush. Between the farm and the bush ran a narrow path and for about fifty yards the ants travelled parallel with this path, keeping under cover of herbaceous weeds and dead leaves. I noticed

that they were joined by one or two apparent stragglers, but whether these were advance scouts, or stragglers from a previous raid, I cannot surmise. No particular ant seemed to be leader, but there was an extraordinary atmosphere of purpose about their march. Once or twice they would hesitate, and the leaders would scatter, soon to reunite and continue the march. This is in marked contrast with the somewhat frenzied bustle of the Drivers, some of which keep running backwards, or break away from the main body in search of any prey that offers, and the main stream frequently divides into several tributaries. I saw an old termitarium some yards away, and thought they might make for it, but to my great disappointment they suddenly turned aside, crossed the path and entered the bush where it would have been impossible to follow them even if it had not been getting dark.

" Early next morning, as I had to return to Ibadan to go on leave, I had to break rudely into the nest. I got a native labourer to dig into it, and he had a fairly lively time. I could not quite make out whether they stung in addition to biting, but I rather think they did. I had not the courage to make the experiment on myself after seeing my labourer dancing round with one on the hard palm of his hand, which he was endeavouring to pick off. Owing to the loose nature of the earth it was impossible to find whether the nest had any particular structure. I found the cocoons roughly massed together, and secured a few. The ants made great efforts to rescue these, all the while hissing loudly. I saw one or two winged forms in the nest, one of which I managed to get but somehow missed it among those I brought home. It appeared to be smaller than the others, which are very uniform in size. I could not distinguish between soldiers and workers. The cocoon is dark in colour, almost black, which distinguishes it from the lighter brown-coloured *Paltothyreus* cocoon.

" They are probably confined to the forest districts, where there is plenty of moisture. The latter is certainly true of *Paltothyreus,* very few of these being found here, up country, except by the river side."

Prof. Poulton said since he had received these notes from Mr. Farquharson he had read the account given by Mr. G. Arnold, M.Sc., in his just published "Monograph of the Formicidae of South Africa," in Ann. S. Afr. Mus., vol. xiv, 1915, p. 1. In this valuable and interesting work the author spoke of the habit of foraging in files as "displayed by *Megaponera foetens*, and to a slight extent by *Paltothyreus tarsatus*. The former marches in double file, and the striking disparity in size between the two forms composing the colony has a very singular appearance. Their prey consists entirely of termites, and when a suitable hunting-ground containing these animals has been found, the columns break up and pour into every hole and crack which leads to the invaded galleries. The method then adopted is as follows: Each ant brings to the surface one or more termites, and then re-enters the galleries to bring up more victims. This is continued until each ant has retrieved about half a dozen termites, which, in a maimed condition, are left struggling feebly at the surface. The whole army reassembles again outside, and each marauder picks up as many termites as it can conveniently carry, usually three or four. The columns are then re-formed and march home. Less order is shown by *P. tarsatus*, but I have often seen this ant carrying termites, in short files composed of about a dozen workers" (p. 8). Mr. Arnold states that the stridulation of both these species "is plainly audible at a distance of several feet" (p. 8). The author described (pp. 47–49) the ♂, the ♀, and two worker forms of *M. foetens*, and said that "it is a common ant in Rhodesia, and lives almost exclusively on termites. . . . This is the species which is popularly called the 'Matabele' ant, and like its cousin *Paltothyreus*, it is also endowed with a very offensive odour. They stridulate very loudly when disturbed, and their sting is exceedingly painful. The entrance to the nest consists of one or more simple holes, without any mounds of earth around them." Although, as Mr. Arnold now showed, both these large ants emitted an offensive odour and stridulated, it was evident, on the testimony of many observers, that *Paltothyreus* made great use of the first defence, while *Megaponera* freely employed the second. Mr. Arnold

described (p. 48 n.) an interesting migration of *Megaponera* from an old nest to a new one about 60 ft. distant. About every 15 feet the party halted and waited for all the eggs, larvae, pupae, and most of the stragglers. The single queen—never before seen in this species—was captured at the third halt.

Interesting butterflies from the east coast of Madagascar.—Prof. Poulton exhibited specimens from a collection kindly sent to the Hope Department by Archdeacon G. K. Kestell-Cornish, from Ambinanindrano, Mahanoro (about 400 ft.).

1. *Hypolimnas bolina*, L.—This butterfly had evidently recently spread to Madagascar, as it is not mentioned by Aurivillius in Seitz's "Macrolepidoptera." The form is that of India and Ceylon, with the mimetic female *jacintha*, Drury, resembling Euploeas of the pattern of *Crastia core*, L. The same form has been known for many years in Socotra. Archdeacon Kestell-Cornish had suddenly noticed this species for the first time in his garden a few years ago. They increased rapidly and had now become one of the commonest butterflies. It was of great interest to observe that the specimens were fairly sharply divisible into the larger dry and smaller wet season forms. A clear succession from the wet (Aug.—Nov.) to the dry forms (Nov.—Mch.) was shown in the table on page lxii.

The males were alone considered in this table because they were more numerous and also because the differences were far more apparent in this sex. Indeed, the mimetic *jacintha* females, both dry and wet, seemed obviously to have been derived from the pattern of the dry form of male. The differences between the two forms of male seemed to be precisely as in the Indian *bolina*. Col. Bingham in vol. i (1905) of the Butterflies in the "Fauna of British India" series (p. 388) stated that "the blue patch on the upperside of the hind-wing is sometimes in both seasonal forms entirely devoid of the pale centering." In the Madagascar specimens, on the other hand, as well as in those from India in the Hope Department, the reduction or absence of the pale centering was certainly a characteristic feature of the dry males alone.

Hypolimnas bolina, L., in Madagascar, 1913–15.

	Females.	Males.	Seasonal form of Male.
1913 : Jan. 8		1	Wet.
,, ,, 11		1	,,
,, ,, 22		1	,,
,, ,, 27	1		
,, Feb. 11		1	,,
,, March 13		1	,,
,, ,, 15		1	,,
,, Jan.–March		1	,,
1914 : July 24		1	Wet side of intermediate.
,, Aug. 12		1	Dry.
,, Sept. 14		1	Intermediate.
,, ,, 16		1	Dry.
,, Oct. 8		1	,,
,, ,, 16		4	2 dry ; 2 intermediate.
,, ,, 22		1	Intermediate.
,, ,, 28		1	Intermediate, nearly wet.
,, ,, 29		1	Intermediate.
,, Nov. 5		1	Dry.
,, ,, 7	2	1	Wet.
,, ,, 10		1	Intermediate.
,, ,, 11	1		
,, ,, 14	2	4	Wet—2 not quite full wet.
,, ,, 27		1	Wet.
,, ,, 30		2	1 wet ; 1 wet side of intermediate.
,, Dec. 3		4	Wet—1 not quite full wet.
,, ,, 5	1		
,, ,, 9	2	2	Wet—1 not quite full wet.
,, ,, 27	1		
,, ,, 30		1	Wet.
1915 : Jan. 1		1	Wet.
,, ,, 7		1	Not quite full wet.
,, ,, 11	1		
,, ,, 18		1	Not quite full wet.
,, Feb. 11	1		
Totals	12	39	

It would be of great interest to trace the relationship between the periods at which the two forms flew at Ambinanindrano and the seasons of Madagascar and of India and Ceylon respectively. It was hoped that the results of this comparison would be communicated to some future meeting.

2. *Acraea encedon*, L.—Twenty *sganzini*, Boisd., and ten *encedon*, captured between Oct. 16, 1914, and Jan. 19, 1915. The whole series only included a single female—a *sganzini* taken Jan. 18. Many of the specimens were captured at the same time and place—10 *sganzini* and 4 *encedon*, Oct. 29; 5 *sganzini* and 3 *encedon*, Nov. 5. The division into the two forms was sharp. The subapical bar of the fore-wing varied in both forms, being yellowish in 8 *sganzini*, paler in 11 (including the female) and worn but probably similar in 1; yellow in 5 *encedon*, white or very faintly yellowish white in 5. All the *encedon* were dull and dark, resembling the continental form described by Aurivillius as *infuscata*. The whole series confirmed the conclusions as to the Madagascar forms and their relationship with those of Africa, published in Linn. Soc. Journ. Zool., vol. xxxii, 1914, p. 395, although the predominance of *sganzini* in the series now exhibited was less than in the previously recorded captures taken as a whole.

3. *Charaxes analava*, Ward, and *Papilio meriones*, Feld.—Concerning this *Charaxes*, captured Feb. 6, 1915, Archdeacon Kestell-Cornish had written: "There is a bad specimen of a butterfly I have never caught before. In flight it is not unlike *Papilio meriones*, but the underside is very different." From this description it seemed probable that the ordinary *Charaxes* flight was modified in the species and that on the wing there was mimicry of the Swallowtail. *Papilio meriones* was evidently common at Ambinanindrano, and several examples had been sent.

4. *Heteropsis drepana*, Dbl.-Westw.-Hew.—Two females of this remarkable and very rare Satyrine were exhibited. Both had been taken Oct. 12, 1914.

A Uganda bug devouring a Lycaenid butterfly.—Prof. Poulton exhibited a pair of *Mononyx grandicollis*, Germ. (Cryptocerata), captured *in cop.* on a bird-dropping on wet

sand, Nsadzi I., W. of Kome I., N.W. Victoria Nyanza, March 30, 1914, by Dr. G. D. H. Carpenter. One of the two bugs was devouring a male *Lycaenesthes larydas*, Cr., also exhibited to the meeting. Dr. Carpenter had written March 14, 1915, in reference to the specimens :—

" What struck me was the beauty of the specialisation. The bugs (resembling the bird-dropping and sand) actually sat on the dropping, presumably for the express purpose of catching Lycaenids which came to feed there. The nicety of the adaptation is what particularly struck me. How long would a bug like that have to wait before it caught a Lycaenid ? True these particular Lycaenids often settle just on the wet sand itself, but the chances of the bug happening to be there seem very remote. It seems to me that the likeness of the bug to the bird-dropping must be an example of Special Procryptic Colouring for offensive purposes, and that they actually tempt the Lycaenids to alight on them. In my experience such adaptations are not common, outside Mantids and Spiders."

Prof. Poulton said that Mr. Lamborn had sent him many Lycaenids captured on excrementitious material at Oni, near Lagos, so there was no reason to doubt that a bird-dropping would be an attraction. The example was in some respects similar to the Malayan bird-dropping-like spider, *Ornithoscatoides decipiens* described by H. O. Forbes. In this case however it was a Hesperid butterfly which had been attracted and captured, although the author stated that he had often seen *Lycaenidae* at rest on bird-droppings (" A Naturalist's Wanderings in the Eastern Archipelago," London, 1885, pp. 63–65).

Observations on butterflies and the attacks made on them by birds, about 30 miles W. of the Victoria Nyanza and about 1° S. lat.—Prof. Poulton read the following letter from Dr. G. D. H. Carpenter. A few sentences from a later letter of March 14 had been added. When there was any importance in retaining the date it had been added to these insertions, but otherwise omitted.

" *Feb.* 1915.

" Well, I am in exactly the same position as when I last

wrote to you, save that I have only one other white man here in the fort with me. We get occasional night alarms, as the enemy's patrols wander about and come and fire on our outlying pickets, but nothing much has happened. We really *did* think one night we were in for an attack, but after a few shots nothing more came of it.

" My mornings and two afternoons a week are fully occupied with my medical duties, but on other afternoons I am free, and am having a great time with butterflies, and am sending you now the first tin full. I think you may, for convenience, allude to them as ' War butterflies.' I should think they are the only ones you have got which have been captured in the enemy's country by one of the army of occupation during the war !

" I have, I think, previously described the country, but will do so again. The hill on which the fort is built rises suddenly out of an absolutely flat plain covered with rather long tussocky coarse grass with here and there clumps of bushes or patches of thorny Acacia trees. The hill has various names but we call it Kakindu, because that is the name of a large plantation and planter's house at the foot of it. About a mile away to the N.W. lies thick forest which is, by the way, continuous with that in British territory on the shore of the Lake, just north of the boundary, known as Tero forest, where I think Neave collected. This forest is of a very different type from that I am accustomed to. Firstly, it seems more recent—one sees none of the very large tree trunks that one met on the islands : it seems as if the trees were not yet full grown. Secondly, of course, the trees are rather different. I haven't yet seen the *Pseudacraea* food plant [*Sapotaceae*]. Thirdly, there is a very abundant epiphyte, hanging from every tree in very long tresses of light grey colour (amongst which the black and white tufted *Colobus* monkey is well concealed). When one looks at the top of the forest from this hill it is mottled with this plant—about the colour of a lichen on old apple trees. Then the undergrowth is of different character, and the huge ropes of rubber creepers hanging in loops—so abundant on the islands—are absent. This is, I think, especially interesting evidence that

the forest is not an old one. Indeed, I venture to suggest that all this flat land was under water at no distant date. I have definite proof that the lake has sunk well over 12 feet since not very long ago, when the island forests——and yet, no, that won't do, because the island forests are also very near the present water level. I collect in the forest along about a mile of partly cleared wood (very fortunate in finding this). The meeting-point of parallels 1° 10′ S. and 31° 30′ E. hits off the locality to within a couple of miles.

" Well, from the difference in the vegetation I expected to find butterflies I had not met on the islands, and I am not disappointed.

" *Pierinae.*—The plains are extraordinarily rich in Pierines. The most abundant is a greenish white one without markings of any kind closely resembled by one with faintest black spots below [probably both are forms of the ♂ *Pinacopteryx pigea*, Boisd., and *P. vidua*, Butl.]. These congregate by hundreds at marshy spots, and make a very wonderful sight when they are disturbed. Among them are various species with the underside boldly spotted with black, and bright orange at the costal margins [probably species of *Belenois*, *Mylothris*, etc.]. I expect some of these are mimics, but am very ignorant of the Pierines. (There is an excellent little ' Blue ' [*Phylaria cyara*, Hew.] which has the underside very nicely mimetic of these whites—quite an exceptional type of underside for a Lycaenid—and it drinks with them.) Then the orange-tipped *Teracoli* are met with [all sent were *T. evippe*, L.].

" *Colias electo*, L., abounds, and I think its pale-coloured female [♀ form *aurivillius*, Kef.] more abundant than the type [13 ♂♂, 4 type ♀♀, and 19 pale ♀♀ were sent]. I have got 3 *in cop.* In the forest those feebly flying species (like *sinapis*) abound [*Nychitona medusa*, Cr.], but except for *size* I can see no distinctive differences. As some are at least twice as big as the others I take them to be different. *Terias*, also, is common, and I have 4–5 species [3 were sent—*regularis*, Butl., *senegalensis*, Boisd., and *brigitta*, Cr.].

" It is a wonderful sight to see the enormous number of Pierines that congregate at a pool at the edge of the forest where I collect, or to see a steady stream pursuing each other

up and down the cleared space in the forest up which some of them come from the open plain outside.

" *Papilioninae.*—As regards *Papilios*, congratulate me on at last catching *P. ridleyanus*, White. Its *Acraea* models are (since I have been here) extraordinarily scarce. *A. zetes*, L., I have only seen once or twice, and *egina*, Cr., not at all. I note that the *Papilio* sometimes has a trace of yellow near the apex of the front wing, suggesting the *eastern zetes.** [March 14.—' I have caught a great number of superb specimens of *P. ridleyanus* at our well, where I think they must collect from a long distance,—for one rarely sees them elsewhere. I have only once seen one in the forest.' All the *ridleyanus* sent are males.] *P. cynorta*, F., ♂, was very common at one time. I have only seen one ♀—which to my joy I caught (you will remember I have not met her before). She was of the black and white western type [mimetic of the ♀ *Planema epaea*, Cr.]. I much look forward to getting more. *P. dardanus*, Brown, ♂, I have seen, but no ♀. [March 14.—' I have caught a *hippocoon*, F., and *planemoides*, Trim., and it nearly broke my heart to *kill* them ! However, I have since found a lemon tree (I don't know their wild food-plant), so that the next ♀ I catch shall lay eggs for me ! '] There is a very interesting species [*P. nobilis*, Rog.] which I have never before seen to my knowledge. It is like ♂ *dardanus*, but with black areas on fore-wing dull buff, and the yellow not so bright. It is of same size and build and flight as *dardanus* ♂, and must be very closely allied. Can you tell me its name, and what ♀ is like ? † Lastly, I have caught,

* This interpretation is supported by comparison with specimens from further W., in the Hope Department. Only the faintest trace (about 11 yellow scales) were found on the left side only of a single ♂ *P. ridleyanus* from the Kassai R., S.W. Congo State, while no traces could be found in 22 other ♂ ♂ from the same locality, in 6 from N. Nigeria, 1 from Angola and 1 from Bangaluo. Out of Dr. Carpenter's 19 ♂ ♂, on the other hand, 2 were strongly marked, 3 slightly marked, and 2 in an intermediate condition. E. B. P.

† The ♀ is said to resemble the ♂, but the single ♀ at Oxford is distinctly different, having additional rows of dark markings on the hind-wing. It may be suggested as probable that *P. nobilis* is a mimic of the ♂ *P. dardanus*. The former is really closely allied to *hesperus*, but its pattern bears a strong superficial resemblance to *dardanus*, and now Dr. Carpenter tells us that the two butterflies are alike in flight. E. B. P.

with pleasure, some of the showy black and green species [*P. phorcas*, Cr., and *policenes*, Cr.] which did not occur on the islands in any quantity but do here.

" *Danainae.*—Of course *D. chrysippus*, L., is plentiful. I believe I saw one day (of course without a net) a variety I have not met before—no black (or white) on fore-wing, but with *white hind-wings* [the form *albinus*, Lanz.]. *Melinda* [*mercedonia*, Karsch] and *Tirumala* [*petiverana*, Dbl. and Hew.] are both more abundant than I have seen anywhere. (I remember you said I might get *P. rex mimeticus*, Rothsch., here. *P. leonidas*, F., is not uncommon.) *Amauris* is *very* scarce. I have only seen a few *echeria*, Stoll. Perhaps, however, things will alter in a few months. [March 14.—' I believe I have once *seen A. niavius*, L., in the forest; *echeria* is very scarce, also *psyttalea*, Plötz.']

" *Acraeinae.*—At present, save for *encedon*, L., practically absent. I have seen one or two *zetes*, one or two *lycoa*, Godt., and a new transparent red and black one [*A. admatha*, Hew.] in the forest, and that's all. Very interesting! Think of Bulago, Kome, etc., with their enormous abundance of Planemas and Acraeas. [March 14.—' Acraeines still very scarce, but Planemas are beginning to appear. I have caught a ♀ *tellus*, Auriv., and one *poggei*, Dew. I have also caught a few *zetes* and *egina*, Cr., now, and one *pharsalus*, Ward.']

" *Nymphalinae.* — Except for *Hypolimnas misippus*, L., I have seen no mimetic Nymphalines here. (Since this was written I have seen one big *Euralia* in the forest.) I have taken a *Precis* new to me on the plains, and one or two new species in the forest; but have not seen anything yet of very much interest. *Neptis* is not uncommon—several species.

" *Satyrinae.* — The common *Mycalesis* here is, I think, different from the one I am accustomed to.

" *Lycaenidae.* — So far, I am much impressed with the scarcity of Liptenines in the forest. I have only got three species of this group. In the plain I have got a very minute Lycaenine [*Zizera stellata*, Trim.] quite new to me :—upper surface brown speckled with white, under surface spotted on a common plan. It runs about on the ground with wings half opened in a manner that makes one think rather of a Skipper.

" *Hesperidae.—Baoris niveicornis,* Plötz, is quite common in its own particular locality—just where forest and grass meet. *In* the forest I have got one [*Ceratrichia flava,* Hew.] at least new to me—bright lemon yellow with broad black border. I have got one on the plain also new to me. I haven't seen *Rhopalocampta chalybe,* Westw., but *R. forestan,* Cr., abounds.

" *Heterocera.*—As regards moths, it's quite strange not to see any *Aletis* : even the small pale one [*Leptaletis forbesi,* Druce]—so extremely numerous on the islands—has not yet shown itself. I saw a Lycoid moth (I think Lithosiid) new to me but had no net. I have a small Lycoid Longicorn beetle new to me. I hope I may get more Lycoids and Lycids after rains when trees blossom.

" *Feb.* 19.

" Had a very interesting afternoon. Visited a small puddle of water where many butterflies congregate, and got some nice Pierines and several *P. ridleyanus* which delighted me. Seeing a pair of the common black and white wagtail [probably *Motacilla vidua* *] very busily catching things, I sat down about six yards away from the pool. The birds came back and set to work actively catching butterflies. I watched for ¼ hour, noting down each time one of them ate a butterfly. You will be interested to hear the result. The two birds in the hour ate between them 16 Lycaenids, 9 *Atella phalantha,* Drury (extraordinarily abundant now : it congregates by the dozen), 3 bright yellow *Terias* and one other larger yellow Pierine [evidently *Eronia leda,* Boisd.] with orange wing tips (reminding one of the Mediterranean *Gonepteryx cleopatra,* L.). This is certainly an *under* estimate, for often when watching one bird I heard the other's bill snap, and giving him a hasty glance saw that he was swallowing something—probably Lycaenid, for they swallow them almost at a gulp. In addition they caught others which got away. But 29 butterflies between two birds in ¼ hour is not bad ! Every now and

* Mr. S. A. Neave considers from Dr. Carpenter's description that "the bird is far more likely to have been *Motacilla vidua* than *M. capensis,* which is a greyer bird. *M. vidua* is much the more widely distributed and also the commoner of the two." Mr. Neave's observations, recorded in Proc. Ent. Soc., 1912, p. lv, were probably made upon *M. capensis.*

then one was so full that he had to sit still and rest—all humped up—and then began again! They had been doing it when I got there and still went on when I left. But quite the most interesting thing was that though there were *dozens* of ' whites ' (in the literal sense) there, *neither of the birds ate one.* I watched one several times walk through a large cluster and put them all up, without touching, or attempting to touch, one. You will see that this did not hold good with the other Pierines there, for 3 *Terias* were eaten. There was no doubt that the wagtails either preferred Lycaenids or else found them easier to catch. The species *Tarucus telicanus*, Lang, was very abundant on the mud, but there were others also whose names I know not. I must go down there and watch them again; for they are always thereabouts.

" *Feb.* 20.

" This afternoon I again visited the puddle by the well. As I came up I saw a wagtail running away with a ' *white* ' in its mouth which it ate. This is interesting after what I said yesterday. I then went a few yards further away to the same puddle I visited yesterday. Two wagtails (probably the same) were there again, busy with the butterflies. One, in *three* minutes, ate *eleven* Lycaenids, and caught others which got away! I began a half-hour watch, notebook in hand, but some men came up and frightened the birds away. I think it quite certain that the birds exercise choice, thus the one last mentioned only ate Lycaenids during the 3 minutes though there were plenty of *Atella phalantha* about; and I noticed yesterday that one seemed to eat more of these than the other. Moreover, while neither of these ate a ' white,' the bird which had its hunting ground a few yards away at the well itself ate one to-day.

" I forgot to mention before that a week or so ago I saw a bird of another kind (size of thrush but rather reminding one of a lark) fly up out of the grass with a large yellow *Terias* in its beak.

" *Feb.* 22.

" This evening I saw a curious sight. When out for a walk I saw a large red patch, about a foot square, on the path,

and when I got up to it saw it was a congregation of many individuals of a coral red (but a dull, not a bright colour) millipede (or should I say Chilognath?), about an inch long. There must have been a couple of hundred or so. The mass was slowly moving in one direction, but the individuals pursued a very erratic course. At first I thought it might be a gathering for family purposes, but could see no evidence of that at all. It was of interest that these brightly coloured species should congregate in this way; for I should think that the Chilognatha must be grouped as 'distasteful,' judging by the extremely offensive excretion they give out when picked up. [It is possible that the gregarious habit serves to increase the conspicuousness of such a specially protected form.]

"*Feb.* 23.

"Another wagtail observation to-day. I went down to the same puddle about 2 o'clock, and one bird was there again, very busy. From 1.55–2 he ate as follows: 1 Lycaenid, 1 *Atella*, 4 Lycaenids; *he then seized one of the extremely abundant 'whites' by the abdomen but at once let go, and the butterfly flew away with the others which rose in a cloud;* he then ate 5 more Lycaenids in quick succession. At 2.0 he ran away to a shady spot and rested for a minute, and from 2.1–2.5 he ate 8 Lycaenids in succession, followed by another *Atella*. He was then frightened away by a man approaching. This, I think, coupled with my previous observations, leaves little room for doubt that the Pierines are *relatively* distasteful as compared with Lycaenids (and *Atella*). This makes the undoubted mimicry of Pierines by Lycaenids all the more interesting. There is one Lycaenid [*Phylaria cyara*], not very common, which has quite an ordinary purplish blue upper side, but the under side is white with only a few black spots (quite unlike any other Lycaenid pattern) and yellow at the base of the hind-wing. I have seen this one drinking amongst a crowd of 'whites,' and its general resemblance to a small Pierine is very striking. The 'tails' to the hind-wing in this species (I send you one or two in the collection I send now) are *very* slender and inconspicuous.

"I am quite certain that the wagtail referred to deliberately

let go the ' white,' and that the butterfly did not *escape* as I have seen some Lycaenids and *Atella* do. Moreover, it seemed to me at the time that the bird did not go for the ' white ' with the same alacrity as when catching Lycaenids or *Atella*, but rather as if it did not much care whether it caught the butterfly or not.

" There were very many butterflies drinking at the puddle:—Of Papilios—*leonidas*, *policenes*, *ridleyanus*, *demodocus*, Esp., a marbled black and white one [*angolanus*, Goeze] I have not met before (common here, I send you some), and one of the black ones with broad metallic green band [*P. phorcas*]; of Pierines—about half a dozen species of ' whites ' (they are always *very* numerous), several species of *Terias*, and one or two other species; of Nymphalines—practically only *Atella*, but this in great abundance; of Lycaenids—several species in abundance.

" It is a great misfortune that Acraeines are so very scarce here : a few *encedon* are practically all one sees. If there were many drinking among the other butterflies it would be very interesting; for the smaller species are just about the size for the wagtail.

" It is most interesting to see how the various types of butterflies sort themselves out when thus collected. *Pap. ridleyanus* (quite abundant now) always settle all together, so that I put my net over four of them at once ! All the ' whites ' of sundry genera group themselves together—the yellow *Terias* ditto, and the brown *Atella never* mix with the others. The Lycaenids only don't seem to group themselves. Is *P. ridleyanus* a rarity ? I am awfully pleased to meet with it here. I have only caught *two Acraea zetes* the whole time I have collected here, but I *once* saw a single example sitting beside a group of *ridleyanus*.

" I thought you might like to communicate the above observations to the Entomological Society, and so have used up a lot of *very* valuable paper by writing on *one* side only ! Good mark, please ! "

The inaria female of Hypolimnas misippus captured and devoured by a bird at Durban.—Prof. Poulton read the following record contained in a letter received from

Mr. E. E. Platt and dated March 12, 1915, from 403 Essenwood Road, Durban :—

" I witnessed an incident the other day that may be of interest to you. I was watching a female *Hypolimnas misippus* L., var. *inaria*, Cr., laying eggs on some *Portulaca* in my garden. As she was on the wing a bird flew down, carried her off in a flash, and retired to a neighbouring tree. I managed to get a good view of the bird, and saw the body of the butterfly devoured, while some wings fluttered down. I described the bird to Mr. Millar, and he showed me a Paradise Flycatcher, *Tchitrea* (*Terpsiphone*) *perspicillata*, Swains., which I had no hesitation in identifying as the culprit. I had been watching the butterfly for some time from the verandah, in company with my little boy, and it was not more than 8 feet away from us when the tragedy occurred. I expect the bird did not see us, as we were sheltered.

" The corresponding *dorippus*, Klug (*klugii*, Butl.), form of *Danaida chrysippus*, L., is very rare here, and I have only taken one specimen—a case of the mimic being commoner than the model, although not so common here as the ordinary type form of ♀, mimicking the black-tipped white-barred *D. chrysippus* which is so abundant with us. It might have been more interesting if the victim had been of this commoner mimetic female form. I may say that *H. misippus* is more plentiful here this year than I have known it before."

Comments were made by Dr. Longstaff and Mr. Swynnerton.

Papers.

The following papers were read :—

" New Lepidoptera from New Guinea," by J. J. Joicey, F.L.S., F.E.S., A. Noakes, F.E.S., and G. Talbot, F.E.S.

" Descriptions of South American Micro-Lepidoptera," by E. Meyrick, B.A., F.R.S., F.E.S.

" Life-History of *Caligo memnon*," by F. L. Davis, M.D., F.E.S.

" Some Palaearctic Species of *Cordulegaster*," by Kenneth J. Morton, F.E.S.

" Experiments on some Carnivorous Insects," by C. F. M. Swynnerton, F.E.S.

Wednesday, June 2nd, 1915.

The Honble. N. Charles Rothschild, M.A., F.L.S., F.Z.S., President, in the chair.

Election of a Fellow.

Dr. A. B. Northcote, Blenheim House, Monkgate, York, was elected a Fellow of the Society.

Exhibitions.

Larvae of Agriades escheri.—Dr. Chapman exhibited some full-fed larvae of *Agriades escheri* bred from the egg. They were of the Pyrenean form (var. *rondoui*), which is smaller and less heavily marked than the central European form. The larva is also smaller and paler. As distinguished from other similar larvae of blue butterflies (*Polyommatus* and *Agriades*), perhaps the most definite points are the brightness and especially the narrowness and definition of the yellow lateral line, and the absence, or all but absence, of the dorsal yellow lines. The colour of the hairs distinguish it from *P. icarus* and *A. thersites*, which otherwise it perhaps most nearly resembles.

Variation in Ornithoptera alexandrae. — Mr. O. E. Janson exhibited specimens of *Ornithoptera alexandrae* selected from a series to show the extreme variations in the wing-markings; also a female example of *Morphotenaris kenricki*; all from New Guinea.

Method of breeding Psocidae, etc.—Mr. C. B. Williams exhibited a method of breeding *Psocidae* and other small insects which feed on fungi, etc. It consists of a large test-tube with a constriction near the base; the lower compartment was partly filled with water and the constriction plugged with absorbent cotton-wool; in the upper part the medium on which the fungus is growing (bran, potato, wood chips, etc.) is placed, and finally the mouth of the tube is also plugged with cotton-wool. The water in the lower chamber keeps the upper one sufficiently moist for fungus and insect life without any condensation on the glass. The tube shown

contained *Psocidae* (species undetermined) which were thriving on bran on which fungi were growing (*Trichothecium* and *Penicillium*). A few of the *Psocidae* were introduced into the tube last September, and now, after about nine months, during which time the tube has not been opened, there were large numbers of all stages in very healthy condition.

Bee and plant fertilisation.—The Rev. F. D. Morice exhibited a ♀ of the solitary bee *Andrena labialis* taken near Woking on May 19, 1915, having attached to the disc of its clypeus a vegetable substance apparently a pollinium of some orchid.

Noteworthy Ants.—Mr. Donisthorpe exhibited specimens of *Anochetus cameroni*, Forel, a new species taken by Dr. Cameron at San Roque, December, 1914, and *Cremastogaster inflata*, F. Smith, taken by Mr. Bryant at Sarawak, December, 1913. The latter species has the thorax distended, which acts as a reservoir for honey, in the same way as the distended gasters of the true "Honey Ants."

Further observations on African insects by Dr. G. D. H. Carpenter.—Prof. Poulton said that he had received another consignment of insects and further letters from Dr. Carpenter, who still remained in the same locality, viz. Kakindu, about 30 miles west of the Victoria Nyanza, 1° 10′ South lat. and 31° 30′ East long. Writing March 22, 1915, Dr. Carpenter had added the following information to the notes read to the Society on May 5 last:—

"By the way, in my 'Wagtail observations' I forgot to mention that though Acraeines were not at the pool drinking, *Tirumala mercedonia* [Karsch] was there, and at one time I saw a wagtail sitting on a large stone on which half-a-dozen *mercedonia* were also sitting, within a few inches of it, but taking not the least notice of them (even less than it did of the numerous 'whites'), although it would eagerly seize any of the numerous *Atella* which it could get, when they settled there."

The following captures were exhibited to the meeting:—

1. *Nineteen males of Papilio ridleyanus, Ward.*—Dr. Carpenter, in his letter published in Proc. Ent. Soc. 1915, p. lxiv, had called attention to the frequent occurrence of

an orange subapical patch on the fore-wing upper surface of *ridleyanus* from Kakindu and had suggested that the marking was related to the pattern of the eastern *Acraea zetes*, L., viz. the form *acara*, Hew. The comparison of Dr. Carpenter's 19 male examples with those from further west had confirmed this suggestion (p. lxvii, n.). Nineteen additional males captured between February 23 and March 10, and received in Dr. Carpenter's second consignment, were now exhibited, providing still further confirmation. The orange marking was conspicuous in 3 examples, small in 4, represented by a slight dusting of orange scales in 6, and absent from 6.

2. *A new Longicorn mimic of the Lycidae.*—Dr. Carpenter had noted concerning the longicorn beetle (*Lamiidae*), *Synnupserha homeyeri*, Har., var., that it was an "excellent lycoid on wing." The specimen, captured in thick forest, February 13, 1915, had been kindly named by Mr. C. J. Gahan.

3. *A Pyrrhocorid bug mimicking a Mutillid.*—Dr. Carpenter had written the following note with reference to the Pyrrhocorid *Myrmoplasta potteri*, Martin: "Captured, Kakindu plain, March 7, 1915, as a Mutillid. General appearance and movements *very* like. Abdomen when alive plump and rounded, and of brighter red. The insect quite took me in."

A COMMON SYNAPOSEMATIC ASSOCIATION OF MALE AFRICAN PIERINAE PROBABLY SPECIALLY RELATED TO THE HABIT OF DRINKING AT DAMP MUD.—Dr. Carpenter had spoken (Proceedings, 1915, p. lxvi) of the immense numbers of Pierines assembling to drink at damp mud, of the evidence that they were but little attacked by wagtails, and of the mimicry of one of the commonest Pierine underside patterns by a Lycaenid, *Phylaria cyara*, Hew., which also came to drink at the same place.

The Pierines which thus assembled were probably always males. Mr. C. A. Wiggins had captured 153 specimens over a pool at the Rippon Falls, Jinja, February 2, 1906, and all were males (Proc. Ent. Soc., 1906, p. l). The simple and characteristic underside pattern mimicked by *Phylaria cyara* was best represented in these Kakindu collections by the

males of *Mylothris spica*, Mösch., and *M. poppea*, Cr., closely resembled by the males of *Pinacopteryx dixeyi*, Neave, and *Phrissura sylvia*, F., respectively—associations described many years ago by Mr. S. A. Neave (Trans. Ent. Soc., 1906, p. 221) and Dr. F. A. Dixey (Proc. Ent. Soc., 1907, p. xviii). The pattern at Kakindu consisted of a white ground-colour with black marginal spots, a large orange flush at the base of the fore-wing and a much smaller one at the base of the hind-wing costa. This latter marking in some species formed a narrow costal streak varying in length in different forms, or in varieties of the same species. The black apex of the fore-wing upper side was also more or less obscurely visible on the under—especially so in *Phrissura sylvia*. Other Kakindu species exhibiting modifications of the same pattern were the males of *Mylothris agathina*, Cr., with smaller marginal spots, orange of a deeper tint, and exposed ground-colour yellow instead of white, mimicked by some males of *Pinacopteryx pigea*, Boisd., with still smaller spots, smaller flush of the same deep tint, and paler yellow ground-colour; the male *Glutophrissa epaphia*, Cr., without the spots, but with orange flush like that of the first-named four species and ground-colour only slightly yellower than these; the male *Phrissura phoebe*, Butl., with smaller spots, linear flush on the hind-wing only, and nearly white ground-colour; the commonest forms of male *Pinacopteryx pigea*, with spots and hind-wing flush evanescent and faint greenish or yellowish ground-colour.

Although Dr. Carpenter's specimens were always accompanied by the most excellent data, the fact of capture at mud was not specially recorded. We knew, however, from Mr. C. A. Wiggins's specimens from Jinja, that *P. pigea* had this habit, for 17 out of the 153 butterflies belonged to this species. Furthermore, Dr. Carpenter had written that on February 19 he had " visited a small puddle of water where many butterflies congregate and got some nice Pierines " (Proceedings, 1915, p. lxix). Among the butterflies captured on Kakindu plain and bearing this date were the following male Pierines: 1 *M. agathina*, 3 *P. pigea*, 1 *G. epaphia*, 2 *P. phoebe*. The pool was again visited on February 20

and the following males from the plain bear this date: 1 *M. agathina*, 3 *P. pigea*, 1 *G. epaphia*, 2 *P. phoebe*—rather a curious coincidence that the numbers of each species should have been the same on the two days. Prof. Poulton had written to Dr. Carpenter and hoped to receive examples of all the species which congregated at mud, showing their relative numbers; but in the meantime it was already evident that the males of several species in this Pierine association have the habit.

With regard to the Lycaenid mimic *Phylaria cyara* the evidence was stronger. Dr. Carpenter had definitely stated that the species drinks with the Pierines at Kakindu, although it was not specially recorded of the four specimens from this locality exhibited to the meeting. But the same naturalist had noted that 2 out of 5 examples, from 6 miles N.E. of Jinja, were captured, December 3, 1910, at a damp spot by the roadside. Furthermore, Mr. W. A. Lamborn had made the following notes concerning 17 specimens of the allied western species *Phylaria stactalla*, Karsch, which possesses a similar Pierine pattern on the under surface.

June 29, 1910. 2 ♂, "on path ½ mile from Oni: When one settled the other settled also a few inches off, and then, gradually sidling up, caused the first to take to flight. This was repeated each time the latter settled, the other walking *sideways*."

July 24, 1910. 2 ♂, on mud, forest, 1 mile E. of Oni, 70 miles E. of Lagos.

August 3, 1910. 1 ♂, on sandy soil, forest, ½ mile E. of Oni.

August 26, 1910. 1 ♀, in clearing, Oni.

August 28, 1910. 1 ♂, on mud, forest, ½ mile E. of Oni.

September 10, 1910. 1 ♀, on flower, forest, ½ mile E. of Oni.

September 17, 1910. 1 ♂, on sheep's excrement, native village, 1½ miles from Oni.

September 19, 1910. 2 ♂, on lagoon shore mud, near Oni clearing.

September 24, 1910. 1 ♂. on mud, forest, 1 mile E. of Oni.

September 27, 1910. 1 ♂, on mud, forest, ½ mile E. of Oni.

October 10, 1910. 1 ♂, in clearing, Oni.

October 10, 1910. 1 ♀, forest, 1 mile E. of Oni.

September 20, 1911. 1 ♀, on top leaf, forest, ½ mile E. of Oni.

October 1, 1911. 1 ♂, forest, ½ mile E. of Oni.

Mr. Lamborn's most interesting notes, copied from specimens in the Hope Department, made it clear that drinking at damp places was a marked habit of the male *P. stactalla*, thus supporting Dr. Carpenter's suggestion as to the meaning of the under-surface pattern.

A Family of Acraea johnstoni.—Dr. Eltringham exhibited a family of five examples of *Acraea johnstoni*, Godm., bred by the Rev. K. St. A. Rogers at Sagalla, British E. Africa, together with the female parent. The latter and four of the offspring were of the form *confusa*, Rogenh. In the parent the hind-wing patch was yellow, in one of the offspring it was of a slightly paler shade, and in three others it was nearly white. The fifth specimen was an aberration perhaps due to starving. It was a small male in which the fore-wing spots were almost transparent, and the pale hind-wing patch much reduced, giving the example somewhat the appearance of *A. lycoa* f. *kenia*, Eltr.

It was interesting to note that the offspring were all of the *confusa* form, whereas in another recorded family bred at Nguelo, Usambara, there were three of the *semifulvescens* or typical form, four *fulvescens*, one *confusa* of the black and white variety, and one *confusa* with yellow patch on hind-wing. Another point of interest in the family exhibited was that though the actual date of pupation varied in the different examples emergence had taken place in every case in nine days after pupation.

In view of a recent discussion he also exhibited a pair of *Acraea braesia*, Godm., taken *in coitû*, in which case the male was carrying the female. The captor, Mr. Rogers, had written to say that this was apparently always the case in this species.

Living Elater sanguinolentus. — Comm. Walker exhibited living specimens of *E. sanguinolentus*, Schr., beaten

from *Pinus sylvestris* at Brockenhurst on the morning of the meeting.

Paper.

The following paper was read :—

" What the larva of *Lycaena arion* does during its last instar," by T. A. Chapman, M.D., F.Z.S., F.E.S.

Wednesday, October 6th, 1915.

The Honble. N. Charles Rothschild, M.A., F.Z.S., F.L.S., President, in the Chair.

Election of Fellows.

Messrs. Arthur Gibson, Entomological Branch, Dept. of Agriculture, Ottawa, Canada, and Harold Beck Williams, 82, Filey Avenue, Stoke Newington, N., were elected Fellows of the Society.

Exhibitions.

Living Larvae of Lycaena arion.—Capt. Purefoy exhibited young larvae of *Lycaena arion*, with an accompanying ant.

Drawings of Lycaenid Larvae.—Dr. Chapman exhibited drawings of various Lycaenid larvae with the Epidiascope.

Dutch Chrysophanus dispar.—The Hon. N. C. Rothschild exhibited four specimens of *Chrysophanus dispar*, taken this year in Holland. The exhibitor stated that he believed the specimens in question were identical with the extinct British race. The examples were secured by Mr. R. A. Polak, 5 Noordstraat, Amsterdam. Two specimens of this insect from Hungary were exhibited for comparison.

A curious case of Syncryptic Resemblance.—Dr. Chapman exhibited a specimen of a Dipteron, a species of *Nemotelus* (Fam. *Stratiomyidae*), sent him by Mr. F. G. Whittle, who said it was quite common where the cases of *Luffia ferchaultella* occurred, and seemed of interest in view of a communication to the Society by the exhibitor (Proc. Ent. Soc. 1901, p. viii) as to the cases of *Luffia* being imitated by a spider

(*Cyclosa conica*). This Dipteron at rest closely imitated the *Luffia* cases, and Mr. Whittle remarked, "When I saw it at rest on a green fence, wings closed and abdomen directed skywards, it quite deceived me." Dr. Chapman observed that this syncryptic resemblance of these three forms suggested a doubt of the distinction Prof. Poulton draws between syncryptic resemblance and mimicry, so far as this instance went, since the resemblance was not merely one of coloration, but also of size and form, leading to some suspicion of mutual advantage, *i. e.* of actual mimicry, though what the advantage might be he was too ignorant of the enemies of these species to guess.

A new Aberration of Euxoa corticea.—Mr. G. Meade-Waldo exhibited a new aberration of *Euxoa corticea*, Hb., taken in his light-trap at Hever, Kent, in July; the specimen, known as ab. *obsoleta*, shows only the faintest trace of the orbicular and reniform stigmata, which are generally so well developed in this species.

Proportions in Mongrel Families.—Mr. L. W. Newman exhibited a very long and varied series of *Aplecta nebulosa* and its varieties ab. *robsoni* and *thompsoni* and intermediate forms. A pairing was obtained in 1914 from male and female both of the *robsoni* form, about 400 ova were laid, of which over 350 were successfully reared to the imago, and the percentages are as follows :—*robsoni* (including intermediates) 50 %, typical specimens 26 %, *thompsoni* 24 %. Also a series of *Boarmia repandata* var. *conversaria*, from a pairing obtained between a *typical* light Hunts ♀ crossed with a *conversaria* ♂. A large percentage of the brood were reared and every specimen produced var. *conversaria* and every one a ♀, which was a most remarkable result.

A new Coccid.—Mr. E. E. Green exhibited specimens and drawings of a new British Coccid, discovered at Camberley upon grasses in uncultivated meadows. Mr. Green remarked that the new species is referable to Signoret's genus *Fairmairia* (now known as *Parafairmairia*), at present represented by a single European species (*F. bipartita*).

Remarkable Hymenoptera.—The Rev. F. D. Morice exhibited :—

1. Gynandromorphous *Hylaeus* (*Prosopis*) *brevicornis*.

In this specimen the clypeus was black (♀ character), the *left* side of the face and the *left* antenna and all the legs on the same side were ♀, but the corresponding parts on the *right* side and the whole abdomen, including the genitalia, were ♂. As to the thorax, he did not know whether in this species there were any characters to be found there which were not common to both sexes, but at any rate he could not detect any such characters in the present specimen.

2. *Halictus laevigatus* ♂.

In this specimen there were only two cubital cells in each upper wing, as in *Dufourea*, *Halictoides*, etc., but in all other respects it was a perfectly normal example of its species.

3. A larva (in spirit) and numerous imagines—all ♀♀(!) —of the Sawfly *Pteronus* (*Lophyrus*) *sertifer* (= "*Tenthredo pectinata rufa*" of Retzius) with cocoons from which they emerged.

The larvae were found at Camberley on June 9, 1915, feeding gregariously on "needles" of a young pine-tree. The first cocoon was formed on June 15, and over a hundred were completed by the end of the month, some among the leaves of their food-plant, but mostly on the sides or flat bottom of the breeding-cage, to which they sometimes adhered very tightly; many of them were consequently *flat* (and not *convex*) on the lower side. Imagines began to emerge, always during bright sunshine and generally between 10 a.m. and midday, on Sept. 12; from 2 specimens up to 6 or 7, according to the amount of sunshine, came out daily all through the same month, and were still doing so.

It was curious that several of the insects very shortly after emergence, but never at any later time, seized in their mandibles and bit through *one* (always only *one*) of their own antennae. Miss Chawner had told him that individuals of the commoner species *pini*, when confined together, attack and mutilate *one another* in the same way. But in this case the injury was always, and could only have been, self-inflicted, since every individual was removed from the cage and isolated directly it came out of the cocoon!

Cameron had stated that the only "definite locality" that

could be given for this as a British species was Hartlepool. But Stephens had long ago recorded it from Ripley and Cobham in Surrey as well as from Scotland. It was evidently most at home in the north, but seemed to be pretty widely distributed wherever pines have been introduced, for Mr. Gillanders had taken it not only in Northumberland but near Bath, and isolated specimens had occurred to Mr. C. Morley in Suffolk, and Mr. Harwood near Colchester.

Further observations from Dr. G. D. H. Carpenter.—Prof. Poulton said that, since the June meeting of the Society, he had received several interesting letters and boxes of specimens from Dr. Carpenter, who had remained until August in the same locality, Kakindu, about 30 miles west of the Victoria Nyanza, in lat. 1° 10′ S., long. 31° 30′ E. The last letter, dated Aug. 9, stated that he had just received orders to move further west to a place which was unfortunately less favourable for the observation of insects. In addition to the facts which he brought before the meeting, Prof. Poulton hoped to give an account of many observations and show many specimens at a later date, when all the material had been studied. The following extract from a letter of May 21st, although not precisely entomological, would be of interest to the Fellows. At any rate it served to show the spirit in which the writer approached the study of animals, including, of course, insects.

"We had a visit from an enemy patrol a few nights ago: one bold man stole up and shot the sentry of a picket through the leg. They deserved a better success, as they must have had an awful time coming through the tussocks of grass and water in the dark; for the whole of the flat plain is so waterlogged that it is practically flooded. From the hill you don't see the water, except where it lies on a trodden bare track; but it's there right enough: the natives go about and spear fish! The fish (I expect a Silurid) is one of the type with flat bony head and barbels, and rather cylindrical body: how they suddenly appear I know not. The natives say they bury in the mud during the drier times. I saw one about 1½ feet long in a tiny temporary stream in the forest, only just covered by the muddy water.

"I had a great experience the other day. I had hardly got

into the forest when I heard the squeal of an elephant on my left. As I went cautiously along the comparatively clear track I heard them coming nearer and nearer and crashing through the bushes, and suddenly saw about 20 yards away on my left front the white tusks of the leader gleaming in the dark shade ! I soon made out his head—apparently coming straight in my direction, so I ran back about 20 yards and got behind a tree to watch. The leader was a fine male, and he turned round and looked in my direction, with ears cocked and trunk uplifted, and I wondered whether my butterfly net would be strong enough to hold him if he charged ! I was only about 50 yards away. However, he thought better of it, and passed across the track into the thick forest again, with the whole herd after him—about 20, females and youngsters of all sizes, in full view—a thrilling sight, and one I shall never forget. There was something rather mysterious about these great silently-treading beasts vanishing again into the forest from which they had as mysteriously emerged. For some time afterwards I heard them crashing about, and an occasional squeal. They are still in the neighbourhood, but I haven't seen them again.

" There are leopards about here, and I want much to see one, but have had no luck. Their droppings are very attractive to *Charaxes* in the forest. One day I was boo'd at by a large party of *Colobus*, which collected in the tree-tops around the cleared space where I was. All of a sudden they all together started making a sort of roaring noise at me, and as there were lots of them it was very striking and seemed to fill the forest. No doubt it was a collective expression of hate ! I one day came across a beautiful Puff Adder (I think *Bitis gabonica*) curled up on the track, and the beast simply *would not* get out of my way until I pushed it vigorously with a stick. I have a rooted dislike to *killing* anything unnecessarily. I did kill Puff Adders on Tavu Island, for they were rather commoner than I liked there, and, as I visited it with my barefooted boys walking, it was rather dangerous for them. Personally I am not in the least afraid of snakes, for (except Puff Adders) I have not yet met one which did not run away, and I see no reason why a snake should waste valuable poison ! Well, this

is enough for a letter. I eagerly wait to hear what you think of the first box of ' War butterflies.' "

Extraordinary habits of a Fossorial wasp.—The following note on the habits of a Pompilid was dated August 9. It was much to be hoped that Dr. Carpenter would be able to repeat an observation which is so different from all that has been previously recorded of the group.

" Now a few words about an interesting thing I saw in the forest on the last day I was there (Sunday, Aug. 8). Walking along, my attention was caught by a medium-sized black Pompilid, with blue-black wings—the common type. It was with a big hunting spider, and when I first saw it had apparently just found it and was stinging it. Suddenly the spider escaped, and the Pompilid hurriedly half ran, half flew, up to it and caught it. The spider then remained absolutely motionless on a leaf, in an attitude suggesting complete subservience to the Pompilid—' do with me what you will,' as it were (reminding one of a dog that lies on its back with all legs up in the air when you speak to it harshly !). The Pompilid *appeared* to be trying to sting it, when the spider suddenly rushed away again, hotly pursued by the fossor, which soon caught it. This time the spider hung from the under surface of a small leaf, and the Pompilid again appeared to be feeling for a soft place to sting, when to my great astonishment it suddenly flew away, having apparently done all it wanted to. The spider hung absolutely limply, as if in the usual semi-paralysed condition. But on examining it I found the Pompilid had *deposited an elongate ovum* on the side of the spider's abdomen, its long axis corresponding to the long axis of the spider, and its curvature following that of the spider's abdomen. Moreover, the spider was in no way paralysed, and when I boxed it was as active as ever, and when I got home leapt out of the box. As I got news just then that I was to move elsewhere on the morrow I let it go.

" The points of great interest are—

1. No Pompilid that I have seen hitherto has laid its egg on a spider until the prey had been safely bestowed in a burrow.

2. The spider apparently feigned death, and took advantage of an unguarded moment to attempt to escape. It showed no fight at all.
3. It was *not* stung.

" This looks as if we had here a Pompilid of such degraded habits that it has lost the art of stinging its prey to immobility and burying it, and just lays an egg on the external surface while the prey is still at large, like a Tachinid or a Proctotrupid —becoming, in fact, merely an ordinary parasite.

" What a pity the specimen escaped me. But that's often the way with fossors : they finish the job and fly off when you think there is still more to come, and you have to choose between an incomplete observation on a known species, or a complete observation on an unknown species."

A small family of P. dardanus, Brown, *bred from the eggs of a remarkable female parent.*—The female parent, captured by Dr. Carpenter in the forest near Kakindu Hill, April 25, 1915, was a rare variety of which but few examples were known. It combined, as Dr. Carpenter pointed out, the patterns of *niobe*, Auriv., and *planemoides*, Trimen. The form *niobe*, however, was only a *trophonius*, Westw. (or *trophonissa*, Auriv., the western form of *trophonius* with a slightly different pattern), having the white markings of the fore-wing replaced by orange. But these very markings were also orange in *planemoides*, and it was probable that their colour in this variety was derived from *planemoides* rather than from *niobe*. For when the specimen was examined in a good light it became apparent that these markings were of a paler tint than the rest of the coloured pattern, as if the *planemoides* orange had been diluted over the precise area occupied by the white subapical markings of *trophonissa*. The exact correspondence as well as the sharp distinction between the paler and deeper orange was very striking. As to the rest of the pattern, the hind-wing was *trophonissa*, the fore-wing *planemoides*, with the above modification and with the addition of the *trophonissa* orange on the basal half of the wing. This tint was much dusted with dark scales in the cell and over a narrow area immediately below it.

The following notes were sent by Dr. Carpenter, dated June 28, 1915 :—

" The female parent laid 9 ova on or about April 26. All save one hatched—6 on May 3, 2 on May 4.

" *First ecdysis.* Six May 8, two May 9.
2nd ,, Four May 13, four May 14.
3rd ,, Three May 19, four May 20, one May 21.
4th ,, Four May 26, three May 27, one May 28.
Pupation. 1 June 6 : ♂ imago June 26 (deformed).
2 June 6 : ♂ ,, June 26.
3 June 8 : ♀ *trophonissa* June 26.
(3A June 7 : ♂ escaped June 27.)
4 June 9 : ♀ *planemoides* June 28.
5 June 7 : ♂ imago ,, 28.
6 June 7 : ♂ ,, ,, 28.
7 June 9 : ♂ ,, ,, 29."

The five males and two females, together with the female parent, were exhibited to the meeting. The *planemoides* was as typical as any specimen could be of this variable form; the *trophonissa* was the typical western mimic of *Danaida chrysippus*, L. It was probable that the female parent was a heterozygote between these two forms, which, by mating with a recessive or a heterozygote male, had yielded the two original parent forms, one of which had of course been latent in the male. We were thus led to conclude that heterozygotes of the *dardanus* forms may exhibit intermediate or combined patterns, although as a rule they bear the pattern of the dominant. The proportions of the mimetic female forms, as shown by Dr. Carpenter's collection to exist in the Kakindu forest, would be brought forward with the specimens at a later date. In the meantime it might be said that *planemoides*, *niobe* and *trophonissa* were all present, the first-named apparently in a high ratio. In view of the probability that males bearing the tendency of *planemoides* would often pair with females of the two latter forms or *vice versa*, it was extremely unlikely that the very rare female form captured by Dr. Carpenter bore the usual appearance of the heterozygote resulting from such matings.

Living Myrmecina graminicola.—Mr. Donisthorpe exhibited a colony of *Myrmecina graminicola*, Latr., which he had kept in captivity for over five years, having taken it when it was an incipient colony at Box Hill, May 1, 1910. His object in showing this colony was to call attention to the number of winged females which had been reared in the nest this summer. He stated that over 50 such females and one male had been produced, and that a number of the former had now removed their wings, as do fertilised females. It was a very remarkable fact that only once previously—when the late Lord Avebury had some winged females produced in an observation nest of *Formica fusca*—have females ever been reared from eggs laid in captivity.

Mr. Donisthorpe stated that the ants had been supplied with large quantities of animal food (gnats, and other flies, other ant larvæ and pupæ, etc.), which had no doubt something to do with the rearing of the females, but as all his other observation nests had been treated in the same manner and had not produced such females, this could not be the only explanation.

Papers.

The following papers were read :—

" Observations completing an outline of the Life History of *Lycaena arion*, L.," by T. A. Chapman, M.D., F.Z.S., F.E.S.

" Further observations on the last stage of the larva of *Lycaena arion*," by F. W. Frohawk, M.B.O.U., F.E.S.

" A contribution to the Life History of *Agriades escheri*, Hb.," by T. A. Chapman, M.D., F.Z.S., F.E.S.

" On the early stages of *Latiorina* (*Lycaena*) *pyrenaica*, Boisd.," by the same.

" Notes on the early stages of *Scolitantides orion*, Pall.," by the same.

" New Lepidoptera from the Schouten Islands," by J. J. Joicey, F.L.S., F.Z.S., F.E.S., and G. Talbot, F.E.S.

" Some new *Parnassii*," by A. Avinoff, F.E.S.

" A new Micropterygid from Australia," by A. Jefferies Turner, M.D., F.E.S.

" Record of some new species of the genus *Teracolus* occurring in the northern territories of the Gold Coast, W. Africa," by G. C. Dudgeon, F.E.S.

" *Glossina morsitans*, Westw., some notes on the parasitisation of its pupae," by Hereward C. Dollman, F.E.S.

Wednesday, October 20th, 1915.

The Hon. N. Charles Rothschild, M.A., F.L.S., F.Z.S., President, in the Chair.

Election of a Fellow.

Mr. Charles Ernest Stott, Woodcroft, Eglington Road, Chingford, Essex, was elected a Fellow of the Society.

Exhibitions.

Marsh form of Anthrocera trifolii.—The Hon. N. Charles Rothschild exhibited some examples of an *Anthrocera* (*Zygaena*) bred from cocoons found in a marsh near Camberley. The interest attaching to the specimens was the fact that, though found in a marshy situation, they apparently resembled in all respects the dry, chalk-down form of *A. trifolii*.

Mr. H. J. Turner expressed the belief that the specimens were ordinary *A. trifolii* and not var. *palustris*; other Fellows concurred, and several instances were mentioned of ordinary *trifolii* being found in damp localities.

Dr. G. D. H. Carpenter on the life-history of Papilio hesperus, Westw., and the resemblance of its larva to that of P. nobilis, Rog.—Prof. Poulton in bringing forward the following account, written by Dr. Carpenter, said that the egg had been laid by a female *hesperus* on Kome Island, N.W. Victoria Nyanza. On May 31, 1914, Dr. Carpenter had been collecting in the forest near his camp, and it was probable that he had there actually watched the egg being deposited.

" *Ovum.* Deposited May 31, 1914. Hemispherical, yellowish white, smooth. Hatched June 4.

" *First stage larva.* Black, with dorsal yellow-green patch just behind middle of body and a smaller, similar, patch posteriorly. A pair of spines arises from each segment dorsally, the anterior and posterior pairs largest. First ecdysis, June 8.

" *Second stage larva.* Alternately black and bright yellow, the head being black, first segment yellow, and the body ending in a black area. (N.B.—The larva of *P. nobilis*, on hatching, is of the same appearance.) Second ecdysis, June 12.

" *Third stage larva.* The yellow areas are now green. Third ecdysis, June 17.

" *Fourth stage larva.* The larva is on the whole much more green in hue. The dark colour now occupies the lateral aspect, but is slate-purple instead of black, and becomes tinted with green as the larva grows larger. At the second and third segments the body is swollen. The first segment is entirely green, and there is a large spine at each angle behind the head. The second segment is slatey-purple : it bears a row of six fine black spines at the anterior margin (three on each side of mid line), but the two innermost ones are *very* small. The third segment dorsally is green posteriorly but slate-coloured anteriorly, with six spines, of which the outermost is fine and black, the next fine and green with black base, the innermost merely a rounded green tubercle ringed with black. The fourth segment is green. The place of the outermost of the three spines on the second and third segments is taken by a scarlet dot ringed with black; the innermost spine is missing, while the middle one of the three is as on the third segment. Each segment behind the fourth has only one spine on each side—serially homologous with the middle one of the anterior series. The fifth and sixth segments are slatey-purple with the spines black. On the sixth segment, external to the spine, is a small yellowish patch in line with the scarlet dot on the third segment. Segments 7 and 8 are green dorsally, and the spines are green. Segment 9 is like 5, 10 like 6, and 11 like 7 and 8. The twelfth is whitish, and at its anterior margin is a pair of large whitish spines with the inner aspect of their bases black, joined by a

purplish-white line. There is a pair of black dots just above the anus. Fourth ecdysis, June 24.

"*Fifth and last stage larva.* In its last stage the larva is entirely green (head dull red), with no spines except the pair just above the anus, which are short and whitish pink, with the part posterior to them of the same colour. The margin of the body in contact with the leaf is of a pink tint. On the third segment the sites of the spines are now marked by slight rounded bosses, very small, doubly ringed with black. A transverse pink band across the dorsum of the fourth segment has four slightly darker pink round spots outlined in black. The anterior border of this band merges into the general green tint of the body, but posteriorly it is sharply marked with a narrow black line, which is really only the posterior border of a deep velvety-black band concealed under the overlapping posterior border of the fourth segment and seldom visible. When the larva is ready to pupate, the curvature of its body brings this black band freely into view.

"*Pupa.* Leaf green. Flattened dorso-ventrally, with very marked lateral edge of dead-leaf brown, as are the very short blunt cephalic processes one at each angle of the head. Between head and thorax, and thorax and abdomen, the lateral edge is deeply constricted. Mid-dorsally, a longitudinal brown line, on each side of which, at level of the constriction between thorax and abdomen, is a small russet-brown mark like a hammer with short broad handle the head being directed towards anterior end of pupa. The two constrictions are marked by a linear extension over the dorsal surface of the brown tint along the lateral edge. The dorsal surface of each abdominal segment bears a minute blue-green spot on each side of the brown line, and external to it another separated by a similar interval."

The imago, a male, emerged July 30.

The specimen and its pupa-case were exhibited to the meeting, together with another male and its pupal shell. The latter butterfly, which emerged August 21, was also reared from a Kome larva.

Eggs and young larvae of P. nobilis.—Prof. Poulton said that he had received the following account in a letter written

by Dr. Carpenter from Kakindu, on August 6, 1915. The order to move had unfortunately come about that time, and Dr. Carpenter was therefore unable to rear the larvae. It was much to be hoped that he would complete this interesting life-history at some future date.

"*On July* 28 had a stroke of very interesting luck. Saw a ♀ *P. nobilis* laying an egg. I unfortunately missed her, but found altogether 16 eggs freshly laid. I couldn't resist bringing them home, but don't know if I shall be able to rear them through. It's interesting, in view of what I said about its likeness to *P. dardanus* on the wing, that it lays its eggs rather differently. *P. dardanus* (at any rate in captivity) scatters them about indiscriminately on upper or under surfaces of leaves and stems. But *nobilis* very carefully places them on under side of a very young leaf, and at the extreme edge. In one case there were four eggs on the under surface of one leaf, each separated neatly from its neighbour by a space of about $\frac{1}{4}$ inch. Compared with the eggs of *dardanus*, those of *nobilis* seem rather small. I *do* hope I may rear them through.

"*P.S.*—These have hatched, but all except two of the larvae wandered off the leaves and died. They are *extremely* like the *hesperus* I reared on Kome Island and *not* like *dardanus*."

Observations by Mrs. D. R. Fyson on the proportions of the female forms of Papilio polytes, L., in the neighbourhood of Madras city.—Prof. Poulton brought forward the following observations, recorded by Mrs. Fyson in a letter dated Sept. 1, 1915 :—

"I noticed that a great many Papilios were out in some fields and in a grassy lane leading through them. They were hovering on and around a Verbena (*Stachytarpheta indica*, Vahl.), which grew in great quantities. My husband and I spent two hours, 7.0–9.0 a.m., on August 23 in catching them. They were easy to catch as they hovered over the flowers, and we practically cleared the place, so the numbers ought to give a fairly true proportion. On a second day, August 28, in the same locality and at the same hours we did not catch so many, as we felt it was rather a slaughter of the innocents !

" *Ph. hector* is very common and so is the male *P. polytes*. The two mimetic forms of female seem to be about equal in numbers, but so far I have only seen one *Ph. aristolochiae* model, and that we caught in the same place as the others but on August 27. I thought I saw one on August 28, but failed to capture it. It was flying fast and only settling out of reach. The male *P. polytes* seem to be very much battered. Would that be due to attacks by birds? I have not observed any such attacks yet. I have sent all that we caught with the exception of a few which I have set here."

Prof. Poulton said that Mrs. Fyson had sent the following specimens of which examples were exhibited to the meeting. The *polytes* female forms, with a large white spot in the hind-wing cell, were, as was usually the case in India, transitional by fine gradations into the *stichius*, Hübn., female form, with no white in the cell.

Date in 1915.	*Papilio polytes* f. *romulus*, Cr.			*Papilio* (*Pharmacophagus*) *hector*, L.
	Non-mimetic male.	*Polytes*, L., ♀ mimicking *P. aristolochiae*, F.	*Romulus* ♀ mimicking *P. hector*.	
Aug. 23	22	15	18	8
Aug. 28	12	8	4	4
Totals	34	23	22	12

The label referring to the catch of August 28 stated that " the commonest forms were *Ph. hector* and the male *P. polytes*." Inasmuch as a similar statement was made in the accompanying letter (see above), it was evident that the catches were directed to show the proportion between the mimetic females but not between the *romulus* form and its model; for only twelve of the latter to twenty-two of the former were taken. The entire absence of the non-mimetic form *cyrus*, Hübn., of the female *polytes* from these catches in Southern India formed an interesting contrast with the proportions obtained by Mr. J. C. F. Fryer in Ceylon, but corresponded with the experience of Mr. T. R. Bell in the Bombay Presidency (Proc. Ent. Soc., 1914, p. xcix.). Prof. Poulton hoped that the proportions of the female forms of

polytes would continue to be recorded from many parts of its range. It was interesting that *P.* (*Ph.*) *aristolochiae* should be so rare as compared with its mimic; but it was probable that the proportions would be very different at other times. Two of the male *polytes*, exhibited to the meeting, had probably been injured by the attacks of birds or lizards.

Some British Lycaenids.—The Rev. G. Wheeler exhibited three small boxes of British Lycaenids, taken in July and early August this year :—

(1) *Polyommatus icarus*, Rott., from the Durham coast, remarkable for their large size and the brilliant tint of the ♂ ♂.

(2) *Plebeius aegon*, var. *masseyi*, Tutt, the form from the northern mosses, the ♂ ♂ bright blue, with very narrow black border and conspicuous black marginal spots on the hindwing, the ♀ ♀ strongly suffused with blue, in most cases as extensively as in *Agriades corydon*, ab. *semisyngrapha*; the underside of the ♂ ♂ was remarkably white; amongst the latter was an aberration having lead-coloured hindwings on the upperside, and two with some of the spots of the underside striated.

(3) *Aricia medon*, Hüfn., from the Durham coast, including almost typical specimens; var. *salmacis*, as described by Stephens, the ♂ with a black discoidal spot on the upperside of the forewing, the ♀ with a white one; ab. *similis*, Tutt, the ♂ with a white discoidal spot; ab. *albiannulata*, Harr., with black discoidal ringed with white, so frequently described as var. *salmacis*, the original description of which excludes this form; ab. *vedrae*, Harr., with its extreme form ab. *obsoleta*, Obth., in which the spots of the forewing are missing on the underside, as well as those of the hindwing; ab. *semivedrae*, Harr.; and ab. *inclara*, Harr., with its silvery-white ground-colour on the underside, this specimen being also somewhat striated. To these were added a few var. *artaxerxes*, F., from Kinghorn.

Mr. Wheeler said he had used the name "*aegon*" intentionally, being sure that it was correct, since Linnaeus had used the name *argus* for both species, there being a ♀ *aegon* among

the specimens labelled by him, as had been quite correctly pointed out by Dr. Verity, and the name *aegon* having been given to one of these by Schiffermüller as "first reviser," the other species retained the name *argus* by exclusion.

Mr. Rowland-Brown inquired who was responsible for the use of the name *argus* in Tutt's "British Lepidoptera," and Mr. Wheeler admitted with regret that he was; this, however, was by no means the first occasion on which the change had been made.

A Mantis and Entozoon.—Mr. E. E. Green exhibited a specimen of a Mantis from Ceylon, together with a Gordius worm that had emerged from it. He said that the occurrence was not an uncommon one, and often took place in public on a dinner-table. The insect would fly into the room, attracted by the lights, settle upon the table, and—after a few preliminary contortions—proceed to void one of these curious worms, which sometimes attained a length of five or six inches. Mr. Green remarked that the generally accepted theory of the development of a Gordius was that the eggs are laid in water or in damp spots on the edge of water, and that the young worms bore their way into the bodies of aquatic larvae. When such infested larvae are subsequently devoured by other predaceous aquatic insects or by fish, the worm completes its development in the new host. In the case of the Mantis some other procedure must occur. The Mantis was not itself an aquatic insect and had no opportunity of preying upon aquatic larvae. Any one who had observed a Mantis feeding and had noticed the painstaking manner in which it masticates every particle of its food, must wonder how the immature worms—if they are actually introduced in this manner—can escape destruction in the process.

Mr. Green had observed the emergence of one of these worms from the body of a large Pentatomid bug.

A long discussion followed. Mr. G. A. K. Marshall said that he had received Tsetse flies, and many African locusts similarly infected. Dr. Burr added that the common earwig was also liable to infection. Mr. C. B. Williams said that he had had living specimens of Mantis which drank water,

and asked whether they might not have swallowed the eggs in this way. Mr. Green said that this species of Gordius seemed to dislike water, when he had experimented with them. Mr. H. J. Turner mentioned a case in which a Gordius worm had emerged from the body of an *Erebia* (he thought *E. ligea*), and asked whether the egg might not possibly be eaten by the larva, when deposited in dew on grass. Prof. Poulton said that the probable solution was that the eggs were laid in moisture on leaves; the Gordius worms were certainly to be found on flowers, having no doubt been deposited there by infected insects.

A re-discovered British Coccid.—Mr. Green also exhibited specimens of the Coccid *Gossyparia ulmi*, Geoff. (or *spuria* of Modeer—according to the American authorities). The present examples were collected by Mr. J. C. F. Fryer, on a Cornish elm at Farnham, Surrey.

Prof. Newstead, in his "Monograph of the British Coccidae," made no reference to this species, and it had not generally been accepted as a British insect. The late J. W. Douglas, however, remarked (Ent. Mo. Mag., vol. xxii, p. 159, Dec. 1885) that "Stephens, in his 'Catalogue of British Insects,' gives the names of many species (of *Coccidae*), of which no recent record of their occurrence in Britain exists, and it is very desirable that the statement should be verified." Amongst the names specified was "*Gossyparia ulmi*."

The insect, though a very distinctive one, was inconspicuous and could be easily overlooked. It might even be mistaken for the pupa of a Coccinellid, the curious upturned fringe of secretionary matter being suggestive of the remains of the larval skin that surrounds the pupae of certain *Coccinellidae*.

A gynandromorphous Ant.—Mr. Donisthorpe exhibited two remarkable mixed gynandromorphs of *Myrmica scabrinodis* taken in the same colony at Weybridge, July 30, 1915. He stated that he had dug up the nest and taken it home, but only ordinary males had developed from the sex pupae it contained. This brought the total number of gynandromorphous specimens of ants recorded up to thirty-five, of which seven had been described by himself, and eight were British. He also showed a pterergate of the same species

taken on the same day but in another colony. The fore-wings were represented by two short wings, with traces of veins, the hindwings being very vestigial.

Mimicry of Nychitona medusa, Boisd., by Leuceronia pharis, Boisd., extending to habits and flight.—Dr. F. A. Dixey exhibited specimens of *Nychitona* and *Leuceronia*, remarking on them as follows :—

The resemblance borne by the curious African Pierine *Leuceronia pharis*, Boisd., to forms of the genus *Pontia*, otherwise *Nychitona*, was observed by Doubleday in 1847. His remarks were quoted by Trimen in 1889, but without raising the question of mimicry. That the relation is a mimetic one has been several times suggested since, and in 1908 I called attention to the special likeness between this *Leuceronia* and the form of *Nychitona*, Cram., recently described by me as subsp. *wigginsi* (Trans. Ent. Soc. Lond., 1915, p. 15). Another form of *Nychitona* from the Congo is in some respects still more like *L. pharis*. An extract from a letter lately received from Dr. G. D. H. Carpenter, which Prof. Poulton kindly permits me to read, is interesting as giving an instance of a view founded merely on an examination of museum specimens receiving independent confirmation from an observer in the field. Dr. Carpenter writes as follows, under date of July 6, 1915: "*Leuceronia pharis* is also abundant at times, when a brood comes out. I was amazed that this is in the same genus as *Leuceronia thalassina*! General appearance, shape, habit and flight are totally different. *Thalassina* (both ♂ and ♀) frequently assembles to drink at moist spots, often almost entirely by itself, but sometimes mixed with others, whereas *pharis* is purely a flower frequenter. In my own mind I had put it with *Nychitona medusa*; its whole appearance and feeble build and manner of flying suggested close relationship to *medusa*."

Dr. Carpenter's field experience is especially valuable as showing that the resemblance between the two insects is not confined to their mere appearance, but extends to their habit and manner of flight. Another point of interest in Dr. Carpenter's account is that *L. pharis* is at times abundant, which so far makes in favour of the association being Müllerian,

as there is some ground for believing is the case with the other combinations entered by other members of the genus. Incidentally also it is worth noticing that he speaks of both sexes of *L. thalassina* assembling to drink at moist spots. The drinking habits of male Pierines are well known, but it is certainly somewhat unusual to find the females consorting with them on these occasions.

A FIVE-SPOTTED ANTHROCERA FILIPENDULAE.—Mr. R. ADKIN exhibited a 5-spotted specimen of *Anthrocera filipendulae*. A number of cocoons were collected from grass stems in a field at the top of the downs near Otford, Kent, in June last, and during July some dozens of imagines were reared from them, all of them being of the ordinary 6-spotted form except this one. On the underside slight traces of the sixth spot were distinguishable.

A NEW BRITISH CAPSID.—Mr. E. A. BUTLER exhibited a series of *Brachyarthrum limitatum*, Fieb., a Capsid new to the British list, taken in Epping Forest, July 3, 1915, on aspen. The first British specimen was taken by Mr. C. Morley in Suffolk, July 2, 1904, but remained unidentified till the above capture.

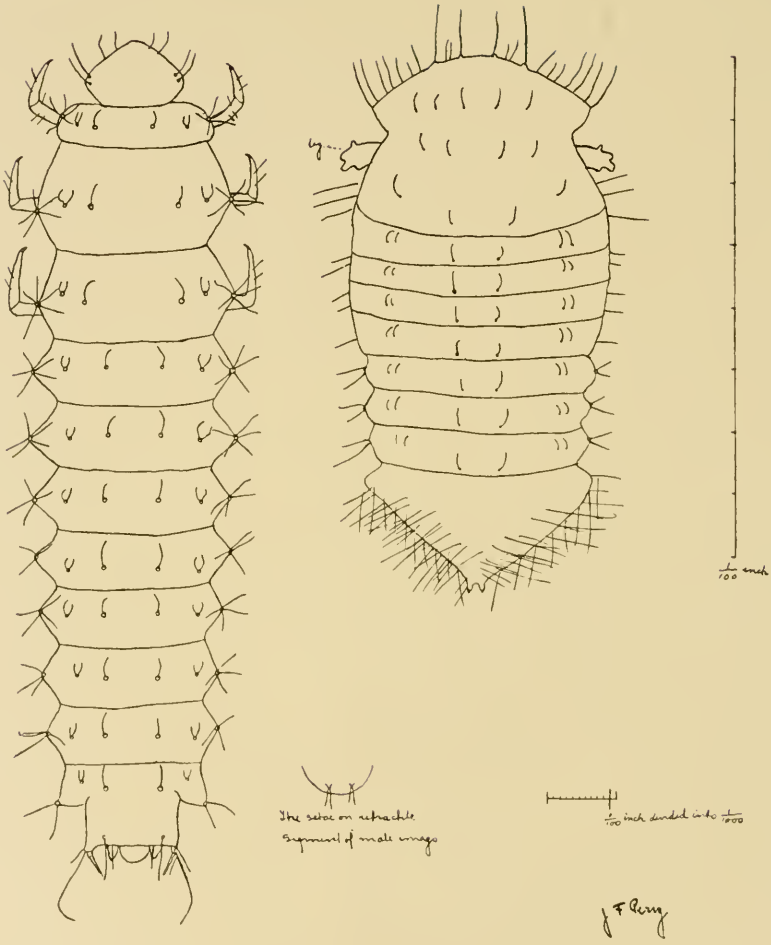
A TERATOLOGICAL BEETLE.—Mr. BUTLER also exhibited a specimen of *Timarcha violaceo-nigra*, De G., with the left intermediate leg furnished with two tarsi, placed upon a much-broadened tibia. The outermost tarsus was nearly normal, but the inner one had the joints broader and more slender, with three lobes on one side and only two on the other.

Wednesday, November 3rd, 1915.

The Honble. N. CHARLES ROTHSCHILD, M.A., F.L.S., F.Z.S., President, in the Chair.

Election of Fellows.

Messrs. H. C. TYTLER, Racoas, Mauritius, and ALBERT F. WINN, 32 Springfield Avenue, Westmount, Montreal, Canada, were elected Fellows of the Society.



LARVA & PUPA OF ALEURODES PARASITIC ON SCYMNUS ARCUATUS.

Exhibitions.

An unrecognised Acraea.—Mr. S. A. Neave exhibited a remarkable and unrecognised species of *Acraea*. The type, which is from Nigeria, is in the Adams Collection in the British Museum, and was described and figured by Lathy, in the Transactions of the Society for 1903, as a Lycaenid, and placed in the genus *Telipna*. The name for this species will therefore stand as *Acraea actinota*, Lathy.

Mr. Neave pointed out that it is such a very distinct species that it is difficult to assign a place to it among the known African species of *Acraea*. From the distribution of the spots and the remarkably short and rounded forewings, it is possibly remotely allied to *A. disjuncta*, Grose-Smith.

Scymnus arcuatus.—Mr. Donisthorpe exhibited a series of *Scymnus arcuatus* Ross., a bit of a leaf of ivy with the pupal skin of the beetle on it, and larvae of the *Aleurodes* on which it preys, also the *Aleurodes* and a chalcid (*Encarsia* sp. ? ♂ and ♀) and a Neuropteron parasitic on the *Aleurodes*, all taken at Stonor Park, Aug. 6th, 1915, through the kindness of Lord Camoys and the Rev. Fr. Perry.

Mr. Donisthorpe said that the late Mr. Wollaston had taken the beetle at Shenton Hall in Leicestershire, but that, as he had taken it first in Madeira, some doubt had been cast on his British captures. Mr. Donisthorpe had been to Shenton Hall some time ago, and the ivy on the walls was in similar condition to that at Stonor Park. He also communicated the following paper descriptive of the life-history of the insect, sent to him by Fr. J. F. Perry.

Notes on *Scymnus arcuatus*.

From July 17th to Sept. 5th over a hundred specimens, including five larvae and five pupae, have been taken on the ivy at Stonor House, five and a half miles from Henley-on-Thames. The sexes were in about equal numbers. On July 31st I found two larvae and four pupae. The smaller of these larvae attacked the other and bit it in the side. It did not recover and was unable to cast its skin, though it took the characteristic shape of a pupa. On Aug. 3rd the other larva pupated, having doubled its size in rather less than four days.

Aug. 4th. A pupa darkened in the morning and emerged the same evening by 10 p.m. A light testaceous, except for a darker shade on the disk of the thorax. In twenty-four hours it was fully coloured; a female. The only variation I have noticed is in the lower light horseshoe band on the elytra; some specimens have only a slight trace of it. The male is easily distinguished by its white head. The insects pair very readily in captivity, and the pairing lasts for an hour. On either side of the retractile segment bearing the genitalia of the male are two movable setae on a short joint. They are just the length of the last ventral segment of the female; during the pairing they spread over this segment like a pair of compasses, giving a firm grip underneath and apparently acting also as an excitant.

Larva.—The larva is somewhat flattened, the head being sunk. It is white and glistening, covered with the powder from the *Aleurodes* larvae on which it feeds. There are six rows of tubercles, each with a pale testaceous, transparent, glossy centre, from which the pale yellow setae grow. These setae are broad at the base and taper to a fine point. They curve inwards in the series on either side of the median line. I think they are glandular, and exude a sticky substance to which the powder of the *Aleurodes* adheres.

The two claws at the anal extremity attach the larva and pupa most firmly to the ivy leaves. The larva arches its back in walking, using these claws. It has three eyes at each side.

Pupa.—The pupa is of the same colour as the larva, but the setae are black and the tubercles much smaller. The membrane enclosing elytra and wings is set with stout bristles. It retains the cast larval skin telescoped into dense folds round its last segments. The tubercles of the first four dorsal segments of the hind body are darker than the rest.

Coniopteryx.—I have found great numbers of *Coniopteryx psociformis*. Mr. Arrow very kindly identified it. Its larva and perfect insect also feed on the larvae of the *Aleurodes*. The larva is covered with the powder of the *Aleurodes*. I kept several in tubes, but had to leave home for a fortnight. On my return I found an imago had emerged, but I missed seeing the pupa.

In mating one clasped the other round the neck with its intermediate legs. The one so clasped turned the end of its body right over its back and so paired. J. F. Perry.

Teratological Lucanid Beetle. — Mr. Willoughby Ellis exhibited a teratological specimen of the common Lucanid beetle *Sinodendron cylindricum*, L., in which the onychium of the right posterior tarsus is much thickened towards its apex, and is triangular in section and furnished with three pairs of perfect claws, one pair of the usual size, one much smaller, and one of intermediate size. The insect is a ♂, and normal in all other respects. It was taken in the decaying wood of an old walnut-tree at Berkswell, Warwickshire, July 1913.

Insects captured Feb. 20, 1915, at the flowers of a Eucalyptus at Healesville, Victoria, by Mr. R. Kelly.— Prof. Poulton said that during the visit of the British Association to Australia in 1914 he had had the pleasure of meeting and collecting with Mr. Reginald Kelly, of Healesville, near Melbourne, and he had suggested to this keen naturalist that it would be extremely interesting to capture a set of insects visiting a particular flower at a particular time. He hoped that in this way much light might be thrown upon the composition of mimetic combinations and the numerical proportions of the species entering into them. Prof. Poulton was also very anxious to test the conclusion that members of these combinations visit the same flowers at the same time. Mr. Kelly had kindly acted on this suggestion, and had sent the insects exhibited to the meeting and taken under the conditions described as follows by the captor :—

" The insects sent in spirit and in paper envelopes were all taken on Feb. 20, 1915, on *Eucalyptus calophylla rosea*—a pink flowering vernacular gum, a native of West Australia, flowering in my garden at Mt. Yule, Healesville, Victoria. The tree was crowded with blossom, and is about 20 ft. high with a diameter of about 15 ft. in spread of boughs, the lowest of which are about 4 ft. from the ground. Specimens of leaf and flower are sent, and allowance must be made for these fading to a lighter shade. The large flies [*Rutilia*] were on the flowers, but rest on the bark of the stem and larger branches

where they are not easily seen. The rough bark of the tree varies from rather light to dark brown and is broken into rectangular pieces. On the stem are holes where the smaller dead branches have dropped out. The tree thus affords shelter and the bark colour protection. [A sketch showed that the flies resting on the bark resemble the scars where the branches have fallen.]

" The Lepidoptera fly mostly high to the top flowers. Those sent came down lower. The tree was crowded with various bees. I think I have sent at least one of each—also blow flies and house flies (few).

" The proportions of the species in the collection sent is a true criterion of their relative numbers on the tree except with the bees, which I did not take freely. My method of taking was to hold the mouth of the spirit bottle over or under the flower, which thus made a stopper and the insect fell in. They were more or less drunk with honey. I did the same with a larger-mouthed cyanide bottle for the Lepidoptera.

" Each year this tree is covered with insects. Sometimes it flowers more freely, sometimes less than this year. You would enjoy the sight. One year a man working in the garden remarked to me, ' My word, it's a regular *aquarium*.' "

Dr. Otto Stapf, F.R.S., of Kew, had kindly given the following information concerning the tree :—

" The variety *rosea* of *Eucalyptus calophylla*, R. Br., is mentioned in Guilfoyle, ' Australian Plants,' 1911, p. 161. There is no author quoted for the variety, nor can I trace it farther back, and it seems therefore to be Guilfoyle's creation. He says nothing about its cultivation. *E. calophylla* was recommended for planting in avenues as early as 1860–61 (see Ferd. v. Mueller, ' Fragm.' II, p. 36). He also mentions it as suffering from frosts at Melbourne in his ' Eucalyptographia,' 1879 (no pagination, but alphabetical arrangement). It was grown in the Melbourne Botanic Garden in 1882 (Guilf., ' Cat. Melbourne Bot. Gard., 64; 1883).

" The species is confined to W. Australia. A form with pink filaments is mentioned by Ferd. v. Mueller in his ' Eucalyptogr.' as very rare, and I assume it is the var. *rosea* of Guilfoyle. *E. calophylla* has for a long time been known as a ' bee-tree.' "

Prof. Poulton said it was interesting that a West Australian tree should be so extraordinarily attractive to such large numbers of Victorian insects. He had been indebted, in the working out of the collection, for much kind help to Mr. G. J. Arrow, Mr. C. J. Gahan, Dr. F. A. Dixey, Mr. J. Waterston, and, on account of the large numbers of Hymenoptera and Diptera, especially to Mr. G. Meade-Waldo, Mr. Rowland E. Turner, and Mr. F. W. Edwards.

Many of the insects having been sent in spirit, it was possible that some changes in colour might have occurred, but the specimens as a whole retained a very fresh and natural appearance. The following colour combinations, including between them nearly the whole of the Hymenoptera, were recognised :—

Combination I. All black ("*I. All bl.*," in list of species). Some of the other combinations are transitional into this, by the extreme darkness of markings or their evanescent character. Thus several members of Combination II would be probably indistinguishable from I at a little distance. All the *Evaniidae* have been grouped under I, although some of them bear very dark reddish markings. The black ground-colour of some of the bees is iridescent, with a steely or bronzy lustre.

Many species belonging to this combination were predominant on Feb. 20, especially *Paracolletes* nr. *vigilans* (32 ♂, 6 ♀), an undetermined species of *Euryglossa* (19 ♀), *Halictus leai* (13 ♀), *Pachyprosopis haematosoma* (55 ♀), and, among the small bees, two species of *Pachyprosopis* and three of *Prosopis*.

Combination II. Reddish, generally combined with black ("*II. Reddish*," in list). The parts marked with red, varying greatly in different species, are shown in the list by means of contractions. The principal members of this combination were three species of *Euryglossa* and one of *Halictus*.

Combination III. Black, with a characteristic median yellow mark on the posterior dorsal surface, scutellum (*mesothoracic*) *and post-scutellum* (*metathoracic*), *of the thorax* ("*III. yell. mk.*," in list). A yellow mark is also present just in front of and generally somewhat below the attachment of the forewing. It is placed on the sides of the mesonotum in *Paracolletes* and *Euryglossa*, on the prothoracic tubercle of the other species of Combination III. The principal yellow

mark is either squarish with the posterior side curved and rather shorter than the others, or else so much shorter and so sharply curved that the mark becomes an isosceles triangle with base directed forwards and with a rounded apex. The squarest mark is seen in *Meroglossa ? nigrifrons*, although here, too, the posterior side is strongly curved. Yellow markings are also seen on the face, the chief resemblances in this respect being between *Euryglossa quadrimaculata* and *Meroglossa ? nigrifrons*, and betweeen *Palaeorhiza nubilosa*, *Prosopis* sp., and, less closely, *Prosopis rotundiceps*. *Paracolletes humerosus* is a far-outlying member of this combination, being without the characteristic median mark, but possessing on the mesonotum, in front of and within the attachment of the forewings, a conspicuous elongated yellow mark resembling in form the pair on the face of *Prosopis* sp., and *P. nubilosa*.

Combination III bears a very characteristic Australian pattern to which my attention was called some years ago by Dr. R. C. L. Perkins (Proc. Ent. Soc., 1912, p. c.). It is probable that a very large number of species, including members of other Aculeate groups, will be found to belong to it. In the meantime Mr. Kelly's captures on Feb. 20 include six bees (without *P. humerosus*), so much alike that, on a superficial inspection, they appear to belong to a single species. The dominant species were *Euryglossa quadrimaculata* (50 ♀) and *Palaeorhiza nubilosa* (15 ♀). Of the remaining five species three were represented each by a single example, the fourth by three, the fifth by six.

Dr. R. C. L. Perkins has kindly supplied the following notes on the species in Combination III.

Paracolletes humerosus. The yellow markings are formed by what I call "squamosity." Whether this consists of modified hairs or excretion through the punctures I am not quite sure. I do not think this belongs to the colour group : it is too dissimilar, especially as other *Paracolletes* do undoubtedly belong to it.

Euryglossa 4-*maculata*. Although the "tubercles" are black and do not enter into the colour-scheme at all, the yellow lateral spots, being restricted to the down-curved

lateral parts of the mesonotum, give a colour effect in dorsal aspect of the insect not very different from that of the yellow-tubercled species, e. g. *Prosopis rotundiceps*, the convexity of the yellow pronotal tubercles rendering these conspicuous in true dorsal aspect. In the scutellum of this *Euryglossa* a small triangular, distinctly divided-off portion is to be seen on each side. These lateral pieces are often called the "axillae." One would have thought this name would have been used rather for one of the small chitinisations *beneath* the root of the wings, but it is an unhappy term anyhow!

In the specimens determined as *Prosopis* sp. ? ♀, *Palaeorhiza nubilosa* ♀, *Prosopis rotundiceps* ♀, *Prosopis nubilosella* ♀, *Meroglossa nigrifrons* ? ♂, the yellow thoracic markings are identically placed, the side-markings being absolutely confined to the *prothoracic tubercles*.

Palaeorhiza nubilosa ♀. This ♀ seems hardly more than a very slight var. of the species I have identified as *Prosopis nubilosa*, from Queensland. I find it almost impossible to believe it can be another genus. My "*nubilosa*" have nothing to do with *Palaeorhiza* (a genus I myself made!), but are *Prosopis*. Unless you have ♂♂ of yours, showing the entirely different tongue of a *Palaeorhiza*, I consider yours *Prosopis*, and the same species as mine.

Meroglossa nigrifrons ? ♂.* This has no resemblance at all to a *Meroglossa* and is not that genus. Its face, antennae, etc., are entirely different in structure, not to mention the tongue. In fact I should say it is almost certainly a ♂ of *Prosopis rotundiceps*.

P. rotundiceps ♀. This practically agrees with my Queensland examples I named thus.

Prosopis sp. ♀. I have ♂♂ which may belong to this species, but I have no name for them. I should think it quite probable that this species belongs to the "*disjuncta*" group of my genus or subgenus *Euprosopis*, but without very minute examination I cannot be sure from a single ♀.

P. nubilosella. I have specimens (also ♀) that I captured at Sydney, June 1904, but I had no name for them.

Combination IV. *Black with narrow yellow abdominal bands*

* Ann. Mag. Nat. Hist., 1912, p. 96.

("*IV. Yell. bd.*," in list). There is great variability in the amount of yellow on other parts. This association includes various different patterns, probably forming large separate combinations, here brought together for the sake of convenience. Thus the ♂ Thynnid *Agriomyia variegata*, of which 281 were taken on Feb. 20, is obviously resembled by the bee *Euryglossa calliopsella* (11 ♀), while *Euryglossa flavopicta* and *E. microxantha* differ in the much greater development of yellow on head and thorax and the replacement of black by a brownish shade on the abdomen. In the other male Thynnids belonging to Combination IV there is an almost complete disappearance of yellow from head and thorax, and the abdominal bands are very pale yellow, extremely narrow and interrupted, so that the insects at a little distance would appear to fall into the all-black Combination I.

Combination V. Black with two broad abdominal bands of dark orange ("*V. Or. bd.*," in list). This, like III, is a very characteristic and highly developed Australian combination. The central models are probably to be found in the *Eumenidae* (Diploptera), while convergent patterns are seen not only in other Aculeates but also in Diptera (*Asilidae*) and Coleoptera (Longicorns and *Buprestidae*). Some of these members of the Combination are represented in Linn. Soc. Journ.-Zool., 1898, vol. xxvi, pl. 41, figs. 5, 5A, 5B, 5C (see also pages 587, 588). Of the two members captured on Feb. 20, the bee *Hylaeoides concinna* was common (4 ♂ 17 ♀), while the Fossor *Crabro* sp. nr. *neglectus* was represented by a single female. Both species are much darker than the ones figured in Linn. Soc. Journ., the thorax and head, as looked at from above, being almost entirely black, and the orange bands, narrower in the *Crabro*, of a peculiarly deep shade.

The following note on Combination V has been kindly contributed by Mr. Rowland E. Turner :—

Fam. *Crabronidae*. *Crabro* (*Solenius*) *tridentatus*, Sm., from S.E. Australia has the broad orange band pattern, whereas *C. tasmanicus*, Sm., from Tasmania, which does not differ appreciably in structure, has narrow yellow bands. The only representatives of the orange pattern in Tasmania appear to

be one or two large and wide ranging *Psammocharidae* and the bee *Hylaeoides concinna*, F., which also has a wide range in S.E. Australia. Tasmanian *Eumenidae* usually have narrow yellow bands on the abdomen.

At Yallingup, on the coast south of Perth, the Australian pattern seemed to be confined to one or two wide ranging *Eumenidae* and *Psammocharidae*, the more characteristic local species of *Alastor* (*Eumenidae*) all having narrow yellow bands. In the Perth district the Australian pattern (V) was not common, though better represented than at Yallingup; still the local *Hylaeoides* has yellow bands, not orange as in S.E. Australia. At Mackay, N. Queensland, a considerable number of wasps had the orange colouring, but nearly all were *Eumenidae*, the only Fossorial examples being *Crabronidae* and *Psammocharidae*.

The colouring does not exist among the *Mutillidae*, *Thynnidae* or *Scoliidae*, and only in *Hylaeoides* among the bees. The Australian pattern is very well represented in the Du Boulay collection from the Champion Bay district, W.A., also, apparently, further inland in W.A., where *Cerceris* and *Arpactus* (*Crabronidae*) are affected; the same genera are also affected in S. Australia and to a smaller extent at Brisbane. At Perth one *Bembex* has the colouring, though nowhere else does the colour occur in this genus, which is well represented in Australia.

Rainfall at Yallingup and Perth about 35 inches; Yallingup more cloudy than Perth; Champion Bay district about 17 inches; further inland 9 inches; Mackay about 75 inches, with well-marked wet and dry seasons; Tasmania cloudy and windy. These remarks seem to show that the colouring is not indigenous in cool moist climates, but is developed in hot and sunny districts, especially in dry climates.

There are also one or two other Australian patterns which are much more local and less dominant, such as testaceous with a black head in the Cairns district, several bees and *Crabronidae* being affected; and black with the second abdominal segment bright red in S.W. Australia, affecting two *Mutillidae* and one *Arpactus* (*Crabronidae*).

The number of undetermined species in the following list

shows that this is a most fruitful method of collecting, and also suggests the large amount of systematic work that remains to be done in the Australian Hymenoptera.

A great preponderance of females is to be expected in insects, especially bees, visiting flowers for honey; but there are some interesting exceptions. Thus thirty-two males of *Paracolletes* nr. *vigilans* were taken, together with six females, probably belonging to the same species. The *Thynnidae*, on the other hand, were chiefly males—again in accordance with the habits of the group; for the males of these Fossores visit flowers, often carrying the wingless female *in coitû*. Some of the species of Diptera (*Lonchaeidae*, *Sepsidae* and *Sapromyzidae*) were probably visiting the tree for egg-laying.

List of species captured by R. Kelly, Feb. 20, 1915, on flowers of a single tree of *Eucalyptus calophylla rosea*, at Healesville, Victoria.

HYMENOPTERA.

Parasitica.

Chalcididae.

(*Eulophidae*)

Gyrolasomyia washingtoni,* Gir.,—3 ♀.

Evaniididae.

Foenus flavitarsis, Guér.,—1 ♀.—I. *All bl.*

,, 2 ♂, 13 ♀ of several undetermined species.—I. *All bl.* (*The dark-reddish colour on some sp. invisible except on close inspection.*)

* The following note has been kindly contributed by Mr. J. Waterston :—

Sub-family *ENTEDONINAE*.

Tribe Omphalini.

Genus *Gyrolasomyia*, Gir. (1913).

Gyrolasomyia washingtoni, Gir. (1913).

G. washingtoni, Girault, Austr. Hym. Chalcid., IV, Mem. Queensland Mus., p. 175 (1913).

Described from one ♀ (Holotype No. Hy. 1706, Queens. Mus.) captured by sweeping in the forest adjoining the banks of Cape River, Jan. 8, 1913.

The ♂ is still unknown.

ANTHOPHILA.

Euryglossa calliopsella, Ckll.,—11 ♀.—IV. *Yell. bd.*
,, *ephippiata*, Sm.,—16 ♀.—II. *Reddish* (*thor.*).
Euryglossa flavopicta, Sm.,—3 ♀.—IV. *Yell. bd.* (*dark bds. brown*).
Euryglossa sp. near *frenchi*, Ckll.,—39 ♀.—II. *Reddish* (*thor., abd.*).
Euryglossa microxantha, Ckll.,—4 ♀.—IV. *Yell. bd.* (*dark bds. brown*).
Euryglossa quadrimaculata, Sm., *var.*,—44 ♀.—III. *Yell. mk.* (2 *yell. spots on abd. instead of typ.* 4).
Euryglossa quadrimaculata, Sm., typical.—6 ♀.—III. *Yell. mk.*
Euryglossa sp.,—19 ♀.—I. *All bl.*
,, sp.,—2 ♀.—I. *All bl.*
,, sp.,—16 ♀.—II. *Reddish* (*with bl. on thor., abd.*).
Euryglossa sp.,—1 ♀.—II. *Reddish* (*ant. abd.*).
Pachyprosopis sp., ?*flavicauda*, Ckll.,—54 ♀, 1 ♂.—I. *All bl.*
Pachyprosopis haematosoma, Ckll.,—55 ♀.—I. *All bl.* (*steely*).
Pachyprosopis sp.,—5 ♀.—I. *All bl.*
,, sp., 25 ♀.—I. *All bl.*
Meroglossa sp., ?*nigrifrons*,* Sm.,—1 ♂.—III. *Yell. mk.*
Palaeorhiza nubilosa,† Sm.,—15 ♀.—III. *Yell. mk.*
Prosopis nubilosella, Ckll., 1 ♀.—III. *Yell. mk.*
,, *rotundiceps*, Sm.,—6 ♀.—III. *Yell. mk.*
,, sp.,—1 ♀.—III. *Yell. mk.*
,, sp.,—14 ♀.—I. *All bl.*
,, sp.,—35 ♀.—I. *All bl.*
,, sp.,—10 ♀, 4 ♂.—I. *All bl.*
Hylaeoides concinna, F.,—17 ♀, 4 ♂.—V. *Or. bd.* (*or. mk.* ♀ *face, yell. mk.* ♂ *face*).

* Considered by Dr. R. C. L. Perkins to be the ♂ of *Prosopis rotundiceps*.
† Considered by Dr. Perkins to be *Prosopis nubilosa*.

Paracolletes humerosus, Sm.,—3 ♀.—III. *Yell. mk.* (*far outlying member of* III).
Paracolletes mimulus, Ckll.,—4 ♀.—I. *All bl.* (*bronzy*).
,, sp., near *vigilans*, Sm.,—6 ♀, 32 ♂.—I. *All bl.* (*steely*).
Paracolletes sp.,—1 ♀.—I. *All bl.* (*bronzy*).
,, sp.,—1 ♂.—I. *All bl.* (*steely*).
Callomelitta picta, Sm.,—1 ♀.—II. *Reddish* (*ant. thor.*)
Halictus leai, Ckll.,—16 ♀.—I. *All bl.*
,, sp.,—1 ♂.—I. *All bl.*
,, sp.,—15 ♀, 4 ♂.—♀ II. *Reddish* (*abd.*),—♂.—I. *All bl.*
Parasphecodes halictus, Sm.,—2 ♀, 1 ♂.—II. *Reddish* (*abd.*)
Exoneura froggatti, Friese,—4 ♀.—II. *Reddish* (*abd.*)
Megachile sp.,—1 ♂.—I. *All bl.*
,, sp.,—1 ♀.—I. *All bl.*
Apis mellifica, L.,—19 ☿.
,, ,, var. *cypria*, Pollm.,—5 ☿.

Fossores.

Thynnidae.

Rhagigaster corrugatus, Turner,—♂ and ♀ *in cop.*,—I. *All bl.* (♀ *red head*).
Rhagigaster pugionatus, Sauss.,—1 ♂, 1 ♀.—I. *All bl.* (♀ *red thorax*).
Rhagigaster sp.,—1 ♂.—I. *All bl.*
Eirone sp.,—1 ♂.—I. *All bl.*
Agriomyia marginilabris, Guér.,—1 ♂.—IV. *Yell. bd.* (*very pale*).
Agriomyia variegata, Klug.,—281 ♂.—IV. *Yell. bd.*
,, sp.,—4 ♂.—IV. *Yell. bd.* (*very pale, sometimes evanescent and transitional to I*).
Agriomyia sp.,—1 ♀.—II. *Reddish* (*head, pt. thor., pt. abd.*).
Asthenothynnus near *lactarius*. Turner,—3 ♂, 1 ♀.—♂ I. *All bl.*, ♀—II. *Reddish.*

Asthenothynnus sp.,—4 ♂.—*All bl.* (*colours probably unseen at little distance*).

Asthenothynnus sp.,—4 ♀ (*probably of above* ♂ ♂)—*All bl.*

Sphegidae.

Crabro sp. near *neglectus*, Sm.,—1 ♀.—V. *Or. bd.* (*pair yell. mks. on face and ant. thor.*).

Rhopalum sp.,—2 ♀.—I. *All bl.* (*slight red ant. abd.*).

HETEROGYNA.

Iridomyrmex sp.,—2 ☿.

COLEOPTERA.

Dermestidae.

Anthrenocerus australis, Hope.—2 ♀.

Chrysomelidae.

Monolepta picticollis, Blackb.—1.

LEPIDOPTERA.

Pierinae.

Delias aganippe, Donov.,—1 ♀.

,, *harpalyce*, Donov.,—1 ♀.

Agaristidae.

Phalaenoides glycinae, Lew.,—4 ♂.

Eutrichopidia latina, Donov.,—1 ♀.

DIPTERA.

Bombylidae.

Geron sp.,—2.

Tachinidae.

Rutilia pellucens, Mcq.,—5 ♂, 2 ♀.

,, *potina*, Wlk.,—3 ♀.

,, *regalis*, Guér.,—3 ♀.

,, *ruficornis*, Bigot,—1 ♂.

,, *vivipara*, F.,—2 ♀.

Muscidae.

Pycnosoma varipes, Mcq.,—47 ♀.

,, *rufifacies*, Mcq.,—1 ♂.

Pyrellia sp.,—2 ♂, 1 ♀.
Musca sp., ? *minor*, Mcq.—1 ♂, 4 ♀.
Calliphora villosa, R.-D.,—1 ♀.
Anastellorhina augur, F.,—6 ♂, 1 ♀.

Lonchaeidae.
Lonchaea sp.,—1 ♀.

Sepsidae.
sp.,—1 ♀; sp.,—1 ♂, 1 ♀; sp.,—3 ♀.

Sapromyzidae.
Sapromyza sp.,—1 ♀; sp.,—1 ♀.

Chloropidae.
Oscinis (*Oscinella*) *quadristriata*, Becker,—4 ♀.
,, sp.,—8 ♂, 3 ♀; sp.,—1 ♀; sp.—1 ♂.
,, ? gen. et sp.,—1 ♀.

Ephydridae.
sp.,—3 ♂, 1 ♀.

HEMIPTERA—HETEROPTERA.

Capsidae.
sp.,—1.

Dr. Marshall inquired whether the tree had been long introduced. He said that in Africa very few insects frequented the Australian Wattle. It appeared to take insects some time to get accustomed to a new plant. He instanced the gradual attacks made by them on peaches in Natal.

Commander Walker remarked on the paucity of beetles in the collection, which seemed as if they took longer than other orders to accustom themselves to an imported plant.

A new Species of Thaumaglossa bred from the Egg-clusters of Mantidae.—Mr. Arrow exhibited specimens of a new beetle, *Thaumaglossa bimaculata*, bred from the egg-clusters of Mantidae, and read the following notes :—

In May last I described two small beetles, allied to the very familiar *Dermestes* and *Anthrenus*, which had been bred, one in Nigeria and the other in Mashonaland, from the papery egg-clusters of Mantidae. Mr. C. J. C. Pool has since received Mantis egg-clusters of two different species (*Sphodromantis*

gastrica and *S. guttata*) from Pretoria, from which he has bred specimens of another species of the same genus. The larvae (which closely resemble those of *Anthrenus*, but have two short terminal tufts of stout black hairs and very long pale hair on the dorsal surface) hollow out the interior of the egg-clusters, without destroying the outer layers, and then pupate in the cavity. They appear to devour both the eggs and the membranous substance forming the protective mass. Species of the genus *Thaumaglossa*, to which these beetles belong, have been long known from Tropical Asia, Australia and the United States (Southern), but their habits seem to have remained unknown. The genus is remarkable for the enormously enlarged heart-shaped last joint of the antenna of the male.

The new species I propose to call

Thaumaglossa bimaculata.

Description. Nigra, antennis, macula transversa utrinque post humerum posita abdomineque postice rufis, undique minute pubescens sed pronoti medio fere denudato; capite rugose punctato, pronoto nitido, lateribus crebre, medio parce, punctato, postice fortiter lobato, lobo truncato, elytris undique crebre punctato-rugosis, subopacis.

Long. 3·5 mm. Hab. Transvaal: Pretoria.

The type is one of several specimens given to the British Museum by Mr. C. J. C. Pool.

The species is closely related to *T. oothecobia* and *T. rufocincta*, but the red band upon the elytra is not continuous as in those, the sculpturing of the elytra is coarser and deeper and the pubescence with which they are clothed finer and less apparent. It is also a little flatter in shape, rather broader than *T. rufocincta* and not quite so short as *T. oothecobia*.

New Lepidoptera from the Wandammen Mountains, Dutch New Guinea.—Mr. G. Talbot exhibited on behalf of Mr. J. J. Joicey a number of new Lepidoptera from Dutch New Guinea, and read the following notes :—

The specimens here shown are some of the forty-four new forms which will be described in the " Annals and Mag. of Nat. Hist."

The specimens were obtained by Messrs. A. C. and F. Pratt

in the Wandammen Mountains, during Nov. 1914. These mountains, which had never previously been explored entomologically, are situated near Wandammen Bay, an inlet of Geelvinck Bay on the north-east side of the island.

The Heterocera are not yet fully worked out and may yield other new forms.

A catalogue of the wonderful collection made by Messrs. Pratt on this and other expeditions in Dutch New Guinea and the Schouten Islands, is in course of preparation.

The following species are shown :—

Papilio (*Troides*) *chimaera* is represented by *dracaena*, subsp. nov. Another race also inhabits Central Dutch New Guinea. We received no ♂ of the present form, but a specimen supposed to be a male of *dracaena* was nearly taken by a native collector, who stated that the hindwing was without black spots.

P. albertisi, Ob., a rare species inhabiting North Dutch New Guinea.

Delias mariae is a distinct species, which has affinity with *clathrata*, R. and J., from British New Guinea.

Delias tessei is nearest to *hapalina*, Jord., from British New Guinea.

Delias caroli, Kenr., inhabits the Arfak district, and a long series was received from the Angi Lakes. It is represented in the Wandammen district by the form shown, and this is another illustration of the local distribution of *Delias* in New Guinea.

Delias thompsoni possesses a pattern distinct from any other in the genus.

Leuciacria acuta, Roths. and Jord. Described from British New Guinea. We received a long series from the Arfak.

Ideopsis vitrea f. *serena* is nearest *arfakensis*, Fruh.

Morphotaenaris schonbergi f. *kenricki* inhabits the Arfak district. From the Wandammens we have a darker race which we have named *wandammenensis*.

Erycinidia maudei is unlike any other species in this curious genus.

Platypthima pandora is allied to a new form sent by Messrs. Pratt from the Arfak.

Platypthima euptychioides is allied to *klossi*, Roths., from the Snow Mountains. These species bear a curious resemblance to S. American forms of the genus *Euptychia*.

Mycalesis fulvianetta, Roths., was described from the Snow Mountains, and is curiously similar to *mahadeva*, Boisd. A new race of the former occurred together with the latter in the collection.

Dicallaneura albosignata and *D. virgo* are new forms only known in the ♀.

Callictita cyara, B.-Bkr., from British New Guinea, is represented by the race *albiplaga* subsp. nov.

Parelodina aroa, B.-Bkr., from British New Guinea, is represented by *mima* sp. nov.

Thysonotis melane sp. nov. is the only species of the genus with an entirely black upperside.

Waigeum bakeri sp. nov., a distinct form only known in the ♀, *Cyaniris pullus* sp. nov., and *Lampides wandammenensis* sp. nov., conclude the Lycaenidae shown.

The following are among the new Heterocera :—

Asura wandammenensis, allied to *phryctopa*, Meyr., from British New Guinea.

Eupterote punctata is allied to our *crenulata* from the Arfak and to *styx*, B.-Bkr., from British New Guinea.

Eubordeta mars represents *rubroplagata*, B.-Bkr., from the Arfak.

Eubordeta discus is a race of *flammeus*, B.-Bkr., from the Arfak.

Milionia rubra and *Colussa inconstans* were described by us from the Arfak.

The following little-known Sphingidae are also from the Wandammens :—

Oxyambulyx jordani, B.-Bkr., *O. euphaea*, R. and J., and *Panacra pulchella*, Roths. This latter was only known previously from British New Guinea.

Aberrant Rhopalocera.—Mr. Stanley Edwards exhibited a small box of aberrant butterflies taken by Mr. Dawson, viz. an albinistic specimen of *Epinephele jurtina* (ab. *semialba*); melanic specimens of *Brenthis pales*, *Melitaea dictynna*, and *M. didyma*, a striated specimen of *Agriades escheri* and a specimen of *Polyommatus hylas* with obsolescent

spotting. The specimen of *M. didyma* was taken at Digne, the others in Switzerland.

Paper.

The following paper was read :—

" On new and little-known species of *Xylophilidae*," by G. C. Champion, A.L.S., F.E.S.

Wednesday, November 17th, 1915.

The Honble. N. Charles Rothschild, M.A., F.L.S., F.Z.S., President, in the Chair.

Election of Fellows.

Messrs. John Wesley Carr, M.A., F.L.S., F.G.S., Professor of Biology in University College, Nottingham, and Albert Harry Hamm, 22, Southfield Road, Oxford, Assistant in the Hope Dept., Oxford University Museum, were elected Fellows of the Society.

Death of Professor Meldola.

The President said he was sure the Fellows would wish, without passing any formal vote, to express their regret at the death of the late Professor Meldola, formerly President of the Society. This was unanimously agreed to, and Professor Poulton asked permission to mention it to the family, whom he would be seeing on the following day.

Nomination of Officers and Council.

The Secretary announced that the Council had nominated all the Officers for re-election, and proposed the following Fellows to act as the Council for 1916. Messrs. A. Bacot, E. A. Butler, B.A., B.Sc., T. A. Chapman, M.D., F.L.S., F.Z.S., E. A. Cockayne, M.A., M.D., J. C. F. Fryer, C. J. Gahan, M.A., D.Sc., E. E. Green, F.Z.S., G. B. Longstaff, M.A., M.D., G. Meade-Waldo, M.A., S. A. Neave, M.A., B.Sc., H. Rowland-Brown, M.A.. A. E. Tonge.

Exhibitions.

Irish Coleoptera.—Mr. O. E. Janson exhibited on behalf of Mr. L. H. Bonaparte Wyse the following Coleoptera taken by him in Ireland this year :—

Carabus glabratus, Pk., Muckross, Killarney; *Carabus granulatus*, L., black var., Mangerton, Killarney; *Pelophila borealis*, Pk., Killarney; *Blethisa multipunctata*, L., Muckross, Killarney; *Badister unipustulatus*, Bon., Muckross, Killarney; *Chlaenius holosericeus*, F., Muckross, Killarney; *Harpalus* 4-*punctatus*, Dej., var. with pitchy legs, Little Sugarloaf, Co. Wicklow; *Anisodactylus binotatus* var. *spurcaticornis*, Dej., Muckross, Killarney; *Pterostichus oblongo-punctatus*, F., Curraghmore, Co. Waterford; *Silpha dispar*, Hbst., Muckross, Killarney; *Melolontha hippocastani*, F., Muckross, Killarney; *Campylus linearis*, L., black var., Muckross, Killarney; *Pogonochaerus dentatus*, Fourc., Curraghmore, Co. Waterford; *Rhopalomesites tardyi*, Curt., Innisfallen, Killarney.

Scotch Dysstroma concinnata.—Dr. Cockayne exhibited a series of *Dysstroma* (?) *concinnata*, Steph., taken by Mr. R. Y. Horn at Tarbert, Argyllshire, July 1915. They were at rest on rocks amongst heather. For comparison *D. concinnata*, Arran, and the two Irish specimens taken by Capt. Gwatkin-Williams, R.N., on Achil Island. Also *D. citrata* ab. *pythonissata* (*immanata*), Shetlands, and *D. truncata*, Sutherland. Also a melanic aberration of *D. concinnata* taken by Mr. Horn on Arran Island. Except the specimens recorded by Curtis from Arrochar, Dumbarton, Aug. 7, 1825, none had been taken on the mainland of Scotland.

Scotch Pieris napi.—The Rev. G. Wheeler exhibited a series of *Pieris napi*, from Kinghorn on the coast of Fife, taken on August 4, 1915, the ♂♂ being remarkable for the extent of the black markings, which form triangles at the end of the nervures on the forewings, the ♀♀ for the extent of the grey suffusion along the costa, inner margin and nervures of the same wings.

A Noctuid Moth feeding on the moisture from the eyes of mules.—Dr. Guy A. K. Marshall exhibited a specimen of a Noctuid moth, *Arcyophora longivalvis* Guen.,

forwarded from Rukuba Hill, 4000 ft., German East Africa, by Mr. W. F. Poulton, a veterinary officer of the Uganda Protectorate, with the following interesting note on its habits. Mr. Poulton was treating an outbreak of South African horse-sickness in a troop of mules when on military service, and when attending the animals at night he constantly noticed a number of moths about them. "They would alight on the animal's head, either in close proximity to the eye or on the nose; from the latter they would make their way straight to the eye, elongate the proboscis and feed on the secretion which collects under the lower lid. The proboscis would also wander over the cornea, making the animal blink several times and causing increased lachrymal secretion. The moths never settled on the rugs with which the mules were covered or on any excreta; they invariably alighted on the head. There was no particular preference displayed for a sick beast over a healthy one." Mr. Poulton very diffidently suggests the possibility that these insects may be the transmitting agents of horse-sickness. Unfortunately this is one of those diseases in which the causative organism is ultra-microscopical, rendering it much more difficult to ascertain the carrier with certainty. It has, however, been sufficiently demonstrated that the carrier is a nocturnal insect, and the work of Dr. Watkins-Pitchford and Sir Arnold Theiler has rather pointed to its being a mosquito and probably an *Anopheles*. It is true that the range of the disease coincides fairly well with that of the moth, but this applies also to *Anopheles transvaalensis* and *A. cinereus*.

Mr. R. W. Jack, Government Entomologist in Southern Rhodesia, has informed the exhibitor that this same moth occurs commonly about cattle kraals in Rhodesia in the evening, flying round the cattle and feeding at their eyes. He suspects that it may possibly carry a form of ophthalmia from which cattle suffer in that country.

Mr. Bethune-Baker inquired whether the moths irritated the animals, and Dr. Marshall replied that apparently they did not annoy them in the least, and Mr. Bethune-Baker then referred to a somewhat similar occurrence narrated in the "Annales" of the Entomological Society of France, but in this

case the annoyance was such as to result in a stampede of the horses.

Mr. Neave related a case in his experience in which many moths were found sucking the moisture (not the blood) from a wounded buck in Africa.

Pentatomid bugs devouring the Lycaenid butterfly A. coridon.—Prof. Poulton exhibited the two examples of a Pentatomid bug, *Zicrona coerulea*, L., and the butterfly referred to in the following letter from Dr. E. A. Cockayne, dated July 26, 1915:—

"I enclose you a freshly emerged male *Agriades coridon*, P., taken at Royston, Herts., July 25, 1915. The two brilliant green bugs were sucking it, one attacking the thorax, the other the abdomen. About forty yards away I found another dead male *coridon*. Like the first it must have just dried its wings before meeting its death. I could find no enemy in this case. Both were on very short dry turf, on the down."

Prof. Poulton said that it was doubtful whether the bugs had killed the butterfly. He had once noticed near St. Helens, Isle of Wight, a dead male of *Polyommatus icarus*, Rott., lying on the ground, and had found a spider in the flower of a buttercup just over the butterfly. In this case the dead body might have been attacked by Hemiptera. Mr. A. H. Hamm had seen and recorded in the photograph exhibited to the meeting the attack of a Capsid bug, *Capsus laniarius*, L., upon *Pieris rapae*, L., after it had been caught and killed by a web-building spider in his garden at Oxford.

In answer to a question by Mr. P. A. Buxton as to whether the bug was known to be a blood-sucker, Dr. G. A. K. Marshall observed that Pentatomid bugs frequently attacked Pierid larvae, and Mr. E. E. Green gave similar instances.

Pyrrhopygid Ova and Imagines.—Mr. W. J. Kaye exhibited ova of *Pyrrhopyge charybdis*, a skipper belonging to the wholly Neotropical sub-family *Pyrrhopyginae*. The eggs for the size of the butterfly were enormous, and it was obvious that quite a comparatively small number could be laid by a single ♀. The eggs were very similar to some Hesperiine species, being ribbed conspicuously longitudinally. The base of the egg consisted of a flat plate of a dark colour, the remainder of

the egg-shell being pale. The micropylar area was small, and the ribs reached nearly to the apex. A number of species of the *Pyrrhopyginae* illustrative of the different genera of the sub-family, including *Sarbia lateizona*, *Yanguna cometes*, *Mimoniades periphena*, *Oxynetra felderi*, *Mysoria acastus*, *Myscelus foronis*, *Microceris variicolor*, *Sarbia xanthippe*, *Pyrrhopyge pelota*, and *Jemadia hospita* were also shown. Also *Pseudosarbia phoenicicola*, a mimic of *S. xanthippe*, and *Pyrrhopygopsis socrates*, a mimic of *P. pelota*; in both cases the mimics belonging to the sub-family *Pamphilinae*. And, lastly, *Phocides pigmalion* of the sub-family *Hesperiinae* mimicking *J. hospita*.

Melanic Cymatophora or.—Mr. G. T. Porritt exhibited a form of *Cymatophora or*, entirely black with the exception of the pale stigmata, taken at Sunderland this year, several of the form having been taken there during each of the past four or five years.

New Butterflies from Biak.—Mr. G. Talbot exhibited on behalf of Mr. J. J. Joicey a number of new butterflies from the Schouton Islands, viz. :—

Papilio priamus f. *teucrus* subsp. n. Six males showing variation. (*a*) The typical form with golden costal spot on hind-wing and discal spots reduced, and in ♀ with two spots in cellule 6 of hind-wing. (*b*) Form transitional to *cronius*, Feld., with only one small discal spot on hind-wing. (*c*) Aberration *cronius*, Feld., a specimen with green suffusion in cell of fore-wing. (*d*) Aberration without gold costal spot on hind-wing and two larger discal spots. (*e*) Aberration approaching *poseidon*, Doubl., with gold costal spot and four well-marked discal spots on hind-wing. (*f*) Aberration *triton*, Feld., hind-wing with three black discal spots and three golden sub-marginal ones.

Danaida marcia sp. n. ♀, with *Euploea pyres* f. *mangolinella*, Strand, ♀, from N. Georgia, Solomons. The Biak Danaine presents a curious resemblance to the Solomon Island Euploeine.

Ideopsis inuncta, Butl., from Waigeu Island, and its race *hewitsoni*, Kirsch, from Biak.

Tellervo zoilus f. *mysoriensis*, Stgr., and *T. assarica* f. *biakensis*

subsp. n. These occur together on Biak and confirm Lord Rothschild's conclusion respecting this genus, that there are two species instead of one as stated by continental Lepidopterists.

Morphopsis biakensis sp. n. This genus was only known before from New Guinea.

Deudorix ceramensis f. *maudei* subsp. n., ♂ ♀. This interesting Lycaenid was first recorded from Ceram by Ribbe, and seems to be very rare. Ribbe records only one male specimen, which came from the mountains of Ceram. On Amboina, Waigeu, and New Guinea is found the allied and more common *despoena*, Hew. This species, in the male, is blue above instead of brown, but the female is similar to that of *ceramensis*.

An ill-placed Wasp's nest.—Mr. Talbot also exhibited cells of a mud-wasp (*Odynerus* ? sp.) formed in the groove of an insect store-box in the Witley Museum; the mud having been collected and brought into the Museum by the wasp.

Paper.

The following paper was read :—

"On the Biology of *Sphodromantis guttata*," by C. B. Williams, B.A., F.E.S., and P. A. Buxton, B.A., F.E.S.

Wednesday, December 1st, 1915.

The Honble. N. Charles Rothschild, M.A., F.L.S., F.Z.S., President, in the Chair.

Election of Fellows.

Mr. K. S. Padmanabha Aiyar, Trivandrum, Travancore, India, and Major Harry Diamond Peile, I.M.S., Bannu, North-West Frontier Provinces, India, were elected Fellows of the Society.

Election of Honorary Fellows.

Prof. Antonio Berlese, Florence, Italy, and Dr. L. O. Howard, Washington, U.S.A., were elected Hon. Fellows to fill the vacancies caused by the death of Messrs. Fabre and von Wattenwyl.

Exhibitions.

Insects from Java.—Mr. A. H. Jones exhibited on behalf of Mrs. Walsh a number of insects from Java, nearly all of which were taken by her in her garden and grounds at Soekaboemi. There were a number of small Heterocera unnamed and a varied collection of insects of other orders preserved in spirits, accompanied in several cases by insects parasitic upon them. This collection, which was also mostly unnamed, promises to be of considerable interest.

British Aleurodidae.—Mr. C. B. Williams exhibited a series of coloured drawings of the pupal cases of the British Aleurodidae executed by Mr. H. G. Osterstock. The following species were represented: *Aleurodes* (*sensû lato*) *immaculata*, *A. phillyreae*, *A. vaporariorum*, *A. proletella*, *A.? quercus*, *A. rubicola*, and an unidentified species from a greenhouse at Wisley; also two photographs (× 6 diameters) of adults and pupae of *A. phillyreae* on a hawthorn leaf.

Notes on breeding from a Melanic Race of Boarmia gemmaria. — Mr. R. Adkin exhibited several families of *Boarmia gemmaria*, and gave the following explanatory notes. From a black female captured in 1907 a brood was reared in 1908, which gave 60 % Black and 40 % Typical. Black was paired with Black and produced in 1909 a brood consisting of 77 % Black and 23 % Typical. Again Black was paired with Black and resulted in 1910 in a brood wholly Black, but which showed evident signs of constitutional weakness. However, Black was again paired with Black, but resulted in 1911 in only two males and three females, all of them Black. For convenience in the following tables I will call this Brood X.

In 1910 I was fortunate in again obtaining ova from a captured Black female, and in rearing from them in 1911 a brood consisting of 33 % Black and 67 % Typical. This I call Brood Z.

From the stocks thus obtained various cross pairings were made as set out in the following table together with the results obtained, given in percentages of Typical and Black and the sex percentage in each.

1911–12.

Brood ABC.

♂ Typical Z × ♀ Black X

Produced

Typical.		Black.	
Male.	Female.	Male.	Female.
Nil	Nil	39 %	61 %
		100 %	

Brood D.

♂ Black Z × ♀ Typical Z

Produced

Typical.		Black.	
Male.	Female.	Male.	Female.
66 %	34 %	49 %	51 %
44 %		56 %	

1912–13.

Brood E.

♂ Black ABC × ♀ Black ABC

Produced

Typical.		Black.	
Male.	Female.	Male.	Female.
70 %	30 %	75 %	25 %
22 %		78 %	

Brood G.

♂ Black ABC × ♀ Black D

Produced

Typical.		Black.	
Male.	Female.	Male.	Female.
42 %	58 %	42 %	58 %
50 %		50 %	

Brood H.

♂ Black D × ♀ Black ABC

Produced

Typical.		Black.	
Male.	Female.	Male.	Female.
53 %	47 %	54 %	46 %
29 %		71 %	

Brood J.

♂ Typical D × ♀ Black ABC

Produced

Typical.		Black.	
Male.	Female.	Male.	Female.
40 %	60 %	40 %	60 %
62 %		38 %	

1913–14.

Brood K.

♂ Black H × ♀ Black H

Produced

Typical.		Black.	
Male.	Female.	Male.	Female.
Nil	Nil	47 %	53 %
		100 %	

Brood M.

♂ Black J × ♀ Black G

Produced

Typical.		Black.	
Male.	Female.	Male.	Female.
17 %	83 %	20 %	80 %
29 %		71 %	

ANNUAL MEETING.

Wednesday, January 19th, 1916.

The Honble. N. Charles Rothschild, M.A., F.L.S., F.Z.S. President, in the Chair.

The Balance Sheet was read by Mr. C. J. Gahan, one of the Auditors, and adopted on the motion of Mr. Stanley Edwards, seconded by Mr. Frisby.

The Rev. G. Wheeler, one of the Secretaries, then read the following

Report of the Council.

One vacancy has occurred in the ranks of the Honorary Fellows during 1915, by the death of Mons. J. H. Fabre, and the Society has also learnt of the death of another Honorary Fellow, Hofrath von Wattenwyl, which took place in 1914. The vacancies thus created have been filled by the appointment of Prof. Antonio Berlese of Florence, and Dr. L. O. Howard of Washington, U.S.A.

Our losses by death in the roll of our ordinary Fellows are phenomenally few, amounting to two only; one of them, Prof. Meldola, was a former President of the Society, the other, Col. Neville Manders, gave his life for his country in the Dardanelles. The Society has also learnt during the past year of the death of the Hon. H. E. Cox, of Jamaica, which took place towards the end of 1914, but this is balanced by the restoration to our roll of Mr. Thomas Dobson, whose death (owing to a similarity of name) was announced last year, but who is still happily an active Fellow of our Society. Eight names have been removed from the list, two less than the previous year, and we have received eleven resignations, which is only two in excess of 1914, and even of these some may be expected to be only temporary. It is, however, in the number of admissions that the war has hit us hardest;

of these we have only 14, to compare with the 34 of 1914, and the 39 of 1913. Our numbers are thus reduced somewhat below those of the last two years, consisting at present of twelve Honorary and five hundred and ninety-six ordinary Fellows, making a total of six hundred and eight.

Our Transactions for this year form a volume of 427 pages, containing twenty-two papers by the following Authors, all of them being Fellows of the Society :—Messrs. A. Avinoff, Dr. Malcolm Burr, D.Sc., F.L.S., F.Z.S., &c., (2), G. C. Champion, A.L.S., F.Z.S., Dr. T. A. Chapman, M.D., F.Z.S., (5), Dr. F. L. Davis, M.R.C.S., L.R.C.P., Dr. F. A. Dixey, M.A., M.D., F.R.S., Hereward C. Dollman, G. C. Dudgeon, Dr. H. Eltringham, M.A., D.Sc., F.Z.S., F. W. Frohawk, M.B.O.U., J. J. Joicey, F.L.S., F.Z.S. (3), (one in conjunction with Mr. W. F. H. Rosenberg, one in conjunction with Mr. A. Noakes, and the third in conjunction with the latter and Mr. G. Talbot), Edward Meyrick, B.A., F.R.S., Kenneth J. Morton, A. Noakes (in conjunction with Mr. Joicey), W. F. H. Rosenberg (also in conjunction with Mr. Joicey), C. F. M. Swynnerton, F.L.S., G. Talbot (in conjunction with Messrs. Joicey & Noakes), and Dr. A. J. Turner, M.D. Of these sixteen refer to the Lepidoptera, two to the Orthoptera, one each to the Coleoptera, Diptera and Neuroptera, and one is of general entomological interest. Though the number of papers is greater by two than in 1914 the amount of letterpress is considerably less, many of the papers, especially of those on the Lepidoptera, being short, though important, contributions to the Life-History of a single species. Amongst these should be specially noticed the solution of the long-standing riddle of the later life-history of the larva of *Lycaena arion*. The plates, however, exceed even the large number produced in 1914, amounting to no less than one hundred and seventeen, and consist of 17 chromo-plates, 10 three-colour plates, 3 black-and-white lithographs, 3 collotypes, 78 half-tone engravings and 6 line-blocks. Of these, nine chromos and eight three-colour plates are given by Mr. J. J. Joicey, two chromos by Dr. Longstaff, and three collotypes by Mons. Avinoff. Mr. K. J. Morton gave a donation of £2 towards the cost of a half-tone plate, and Dr. Chapman

bears half the entire cost of six chromos and sixty-one half-tone plates. The cost of the remaining plates is borne by the Society, but the drawings have in all cases been given by the Authors, except that the drawings for one three-colour plate and six line-blocks were given by Mr. F. D. Godman. The Society has also replaced 600 copies of one of Mons. Avinoff's collotypes, which were lost in transit from Petrograd.

The Proceedings occupy 133 pages, and are illustrated by one line-block plate. They contain in addition to the usual record of exhibits, and the welcome accounts of the observations and discoveries of our Fellows in Africa and elsewhere, three important papers, two of which, *viz.* those by the late Col. Neville Manders, D.D.M.S., F.Z.S., F.E.S., and Mr. C. F. M. Swynnerton, F.L.S., F.E.S., relate to Protective Resemblance, and the third, by Rev. J. F. Perry, gives a life-history of the *Aleurodes* parasitic on the beetle, *Scymnus arcuatus*.

Under the advice of a Sub-committee appointed by the Business Committee, considerable changes have been made in the matter printed on the cover of the Transactions, including a facsimile of the seal designed for the Society by Prof. Image.

A Sub-committee was also appointed by the Council to suggest alterations and additions to the Bye-laws (which must in any case be reprinted, the stock being exhausted); the Council has debated on their report and the suggested alterations will shortly be submitted to the Society.

The attendance at the meetings has been well maintained in spite of the number of our Fellows absent with the colours, and khaki has been no uncommon sight here during the past year.

Several members of the Entomological Societies of allied Nations have taken advantage of our Society's offer of the use of its Library, and there has scarcely been a meeting of the Society this year at which one or more of them has not been present.

The Treasurer reports as follows :—

" The balance sheet compares very favourably with that of last year; in fact, in some respects shows an improvement.

The cash balance in hand is £116 more than this time last year, after paying all accounts rendered. The annual subscriptions show the slight falling off of £20. The item under the head of 'Donations' shows an improvement of upwards of £80, chiefly owing to the generosity of Mr. J. J. Joicey, but the cost of production of plates shows a corresponding increase. The excess in the amount received for sales of publications by about £21 is extremely satisfactory.

"The only unpleasant item in the balance sheet is the continued depreciation in the value of our securities, which now amounts to £507 13*s.* 9*d.*

"A. Hugh Jones,
"*Treasurer.*"

The Librarian reports as follows:—

"Four hundred and thirty-two volumes have been issued from the Library for home reading, and twenty-eight volumes and a large quantity of separata have been added to the Library.

"The Library has also been largely used for purposes of reference.

"Owing to the war very many of the Foreign Magazines are not coming to hand."

The Report was adopted on the motion of Mr. W. J. Lucas, seconded by Mr. C. B. Williams.

No other names having been received by the Secretaries in addition to those nominated by the Council as Officers and Council for the ensuing year, the following were declared by the President, with the consent of the meeting, to be elected:—

President, the Hon. N. Charles Rothschild, M.A., F.L.S., F.Z.S.; *Treasurer*, A. H. Jones; *Secretaries*, Comm. J. J. Walker, M.A., R.N., F.L.S.; the Rev. George Wheeler, M.A., F.Z.S.; *Librarian*, G. C. Champion, A.L.S., F.Z.S.; *Other Members of the Council*, A. W. Bacot, E. A. Butler, B.A., B.Sc., T. A. Chapman, M.D., F.L.S., F.Z.S., E. A. Cockayne, M.A., M.D., J. C. F. Fryer, M.A., C. J. Gahan, M.A., D.Sc., E. E. Green, F.Z.S., G. B. Longstaff, M.A., M.D., G. Meade-

Waldo, M.A., S. A. Neave, M.A., B.Sc., H. Rowland-Brown, M.A., A. E. Tonge.

The President then delivered an Address, illustrated by slides shown in the Epidiascope, after which a Vote of Thanks to him was proposed by Lord Walsingham, seconded by Mr. W. J. Kaye, and carried unanimously, with the request that the Address might be published as a part of the Proceedings of the Society.

The President having shortly replied, Mr. J. Hartley Durrant proposed a Vote of Thanks to the Officers of the Society for their services during the past year; this having been seconded by Mr. A. W. Bacot and carried, the Treasurer and both the Secretaries said a few words of thanks in reply.

ENTOMOLOGICAL SOCIETY OF LONDON.

Balance Sheet for the Year 1915.

Receipts.

	£	s.	d.
Balance in hand, 1st Jan., 1915	108	19	9
Subscriptions for 1915 ...	475	13	0
Arrears	34	13	0
Admission Fees	14	14	0
Donations	153	11	3
Sales of Transactions ...	138	14	4
Interest on Investments—			
Consols ... £29 19 8			
Birmingham 3 per cents. 6 7 4			
	36	7	0
Subscriptions in Advance	18	18	0
	£981	10	4

Payments.

	£	s.	d.
Printing Transactions, etc.	296	0	7
Plates, etc.	251	8	7
Rent and Office Expenses	168	1	4
Books and Binding	22	3	3
Subscriptions in Advance as per contra carried to 1916	18	18	0
	756	11	9
Balance in hand	224	18	7
	£981	10	4

Assets.

	£	s.	d.
Subscriptions in arrear say	93	0	0
Cost of £1,354 2*s.* 2*d.* Consols. Present value at the price of 58½ on 31st December, 1915, £792 3*s.* 1*d.*	1,233	3	0
Cost of £239 12*s.* 4*d.* Birmingham 3 per cents. Present value at the price of 76½ on 31st December, 1915, £183 6*s.* 2*d.*	250	0	0
Balance in hand	224	18	7
	£1,801	1	7

Additional Assets:—
Contents of Library Valued at say £3,800.

Liabilities.

Cost of printing Parts 3, 4 and 5 say £160. Estimated cost of Plates in hand £179, from which has to be deducted £119 the amount promised by Contributors towards the cost thereof, leaving a total liability of say £220 for the year 1915.

Audited, compared with vouchers and found correct, January 11th, 1916—

Chas. O. Waterhouse.
R. W. Lloyd.
C. J. Gahan.
E. A. Butler.
R. Adkin.
Geoffrey Meade-Waldo.

The value of Securities shows a total depreciation of £507 13*s.* 9*d.*

A. Hugh Jones, *Treasurer*.
7th January, 1916.

THE PRESIDENT'S ADDRESS.

Gentlemen,

It is the privilege, and no small privilege, of the President of our Society to give an address at the termination of his year of office, and I can assure the Fellows of The Entomological Society that I more than appreciate the honour which is thus conferred on me. There is no task so difficult for the President of our Society as to give an address, for, whatever theme he may select, he knows at the outset that he is addressing a number of experts, many of whom are far more familiar with the subject he has selected than he is himself. Under these circumstances, perhaps, it would be fit for the President to make a kind of apology that he has to speak at all, but I do not propose to do this; I merely crave your indulgence to listen to the few remarks that I am going to put before you.

In giving my Presidential address this evening, it is hardly necessary for me to point out that we are in the midst of the greatest war ever known in history, and possibly are face to face with the greatest changes that mankind has ever seen. It is therefore not strange that entomology and entomologists should be affected by this titanic struggle. I must mention the deaths of three well-known entomologists. Firstly, the famous French entomologist, one of our honorary Fellows, Mons. Fabre, whose works recording and portraying the marvels of insect biology will remain for ever as a monument of his greatness. Professor Fabre died at a very ripe old age, and his loss is not due to the great struggle which is going on. We have also lost Professor Meldola, another distinguished scientific man whom we cannot replace, and finally I must mention Colonel Manders, whose premature death

has occurred in the present war. Many of our Fellows are serving or have been serving with the forces. The list I give is probably incomplete, and I therefore crave your indulgence for any omissions I may have unintentionally made. A. Avinoff, P. J. Barraud, C. C. Best-Gardner, K. G. Blair, W. Bowater, A. W. Boyd, Dr. Burr, P. A. Buxton, Dr. G. D. H. Carpenter, Dr. Cockayne, P. P. Graves, G. H. Gurney, P. Harwood, J. J. Jacobs, C. Jemmett, E. G. Joseph, E. C. Joy, W. J. von Monte Pendlebury, H. C. Phillips, N. D. Riley, W. F. H. Rosenberg, H. B. Sly, H. F. Stoneham, H. B. Whitehouse, F. H. Wolley-Dod.

Lack of funds owing to the present struggle has delayed the publication of many important works, such as Sir George Hampson's "Catalogue of Moths," and Wytsman's "Genera Insectorum." Seitz's great work is being continued, but I am not certain that any copies reach this country. That this war has affected and will affect entomology, and vitally affect entomology, is a foregone conclusion, and it remains for those of us who live in after years to observe these changes. It should not, however, be forgotten that war in itself is not entirely and solely detrimental to our study. Napoleon's campaign in Egypt, which had no great political results, produced great scientific works, and Napoleon's general, Comte Dejean, made a large collection of Coleoptera during the Napoleonic wars, many officers and soldiers of his army carrying a small bottle in which they put the insects they found. Nor must it be forgotten that economic entomology is playing its part in the trenches. In this connection must be cited the names of Mr. E. E. Austen and Professor Robert Newstead, at the same time not forgetting the labours of the Imperial Bureau of Entomology and our friend Dr. Marshall. There is one other point of interest I would wish to refer to, viz. the unravelling of the complete life history of *Lycaena arion*, the joint work of Dr. Chapman, Mr. Frohawk and Captain Purefoy. It is only those who have striven to solve this riddle and failed, like myself, who can really appreciate the magnitude of their labours, and I feel that this discovery should be brought before the notice of the Fellows here to-night as one of quite exceptional merit.

The subject that I have selected, and am venturing to expound this evening, is that of the preservation of nature. I have selected this subject because it is one in which I personally take great interest, and which I feel has not received as much attention as it really deserves.

I propose to lay before the Fellows of this Society certain facts connected with the preservation of nature, and I can only hope that I may stimulate the interest which I know they already take in this subject.

The world is always changing; it always has been changing, and it always will change. There was, perhaps, never a time when the whole history of mankind was so in the melting-pot as it is at this moment. Geology teaches us that nothing comes to stay, and the world, like Topsy in "Uncle Tom's Cabin," was not born, but growed. It is not these changes that Nature has herself ordained that I touch on to-night, but it is the changes which are due to the actions of mankind, "Nature's insurgent son," as Professor Ray Lankester has termed the human race.

We know that much of the ground which has seen those bloody battles between the Kaiser's army and that of the Czar was, in 1812, when Napoleon passed over it, virgin, swampy forest; it now consists of fields and grazing land for cattle. This change is due to mankind, and I cite it as an illustration of the great change which is coming and going, and passes every year over the whole surface of the globe.

I propose to discuss to-night certain aspects of this change which mankind is bringing about, and how, perhaps, some vestiges of Nature's handiwork, untouched by that of her "insurgent son," may be preserved for posterity.

The preservation of nature in one aspect or another is as old as the hills. The sixth verse of the twenty-second chapter of Deuteronomy is perhaps the earliest game law, as the late Professor Newton called it. Here the warning is given that if you rob a nest with a view to taking the eggs or the young birds, the female should be allowed to go free.

Now the preservation of nature can be attempted in several different ways. Laws can be passed to prevent the killing, or even molesting of animals, birds, insects, and plants.

That legislation of this kind has been beneficial in the past, and is still beneficial, requires no proof from me. We know that "The Wild Birds' Protection Act" in England and on the Continent has helped to re-establish, sometimes in quite large quantities, birds which, at the time it was passed, were on the verge of extinction. Legislation, however, of this nature is not enough, because it is useless to protect anything from the direct attacks of mankind when the home where it lives, or where it can live, is destroyed or partially destroyed by other causes. The protection of nature, therefore, has been, and is being attempted by endeavouring to conserve in its natural state certain areas where the wild life of this globe still exists, such an area being known as a "Nature Reserve."

During the course of my address I propose to lay the facts before the Fellows under two principal headings. I propose first to outline the efforts that have been made, both direct and indirect, in this and other countries, towards the preservation of nature, showing at the same time how the efforts which were not primarily intended for this purpose have given the world beneficial results. I trust, then, that the Fellows will allow me to show them some illustrations of various areas in the world where the preservation of nature on lines such as I have indicated above is being carried out, and to submit to them a few pictures and notes of various live creatures whose protection is especially desirable.

The first effort to create nature reserves—indirect ones, it is true, but still, nature reserves—seems to have been made in this country in the year 1838. As the outcome of a Royal Commission The Aborigines Protection Society was founded. The result of the founding of this Society has been the creation of native reserves in many parts of the world, and the remains of the North American Indian, which still flourish, and of some of the Australian races, doubtless result from the well-merited action of this country.

The Fellows whom I have the honour of addressing to-night perhaps scarcely realise in what need of protection many of the aboriginal races of the world are. It is only necessary to remember that not very long ago a reward was paid for

the ears of every Terra del Fuegian which could be brought in, and an enterprising colonist not long after this edict discovered that putting strychnine in the water-holes where these unfortunate men and women used to drink, produced a rich harvest of human ears and a corresponding expansion of his personal budget.

We are not here, however, to discuss the human aspect of the question, and it is only necessary to touch upon the preservation of the native races of men in connection with this subject. Some of these races, the Tasmanians for example, are already extinct, while others, such as the Bushmen of South Africa and the ancient inhabitants of Ceylon, are yearly diminishing.

The Corporation of the City of London should be mentioned next as having been the real pioneer in the establishment of nature reserves. Here, again, the theory was more that of providing adequate open spaces for an overgrown London than for really conserving, for the benefit of posterity, the fauna and flora of this country. All the same, the result has been highly satisfactory. The action of the City Corporation in this direction dates from the year 1867, so it will be observed that this country is really the first in this highly desirable movement.

I propose to deal again with some of the reserves that exist in England to-day, and exist owing to the exertions of the City Corporation, but it may perhaps be worth while mentioning that the presence of Epping Forest, Burnham Beeches, Highgate Wood, and several other localities which still harbour much of the wild life of this country, owe their reservation to the efforts of the City Corporation.

In 1872 the United States of America established the well-known Yellowstone National Park, a reserve of no less than 2,000,000 acres. Here, again, we shall have more to say about this area at a later period, but I believe I am right in saying that the Yellowstone Park is the first real nature reserve that was ever established, *i. e.* it was established primarily for the purpose of preserving the fauna and flora of the North American continent, and in reviewing the subject generally we must admit, if perhaps with some regret, that this

idea owes its origin primarily to our kinsmen in the New World.

In the year 1884, The National Trust for the preservation of places of natural beauty or historical interest was founded, and this may be regarded as a new era in the protection of the fauna and flora of the British Islands. Here, again, the primary object of the National Trust was not one which appeals either to the zoologist or to the botanist, but indirectly their action has done much to help the movement, and what is more, I am firmly convinced that the great extension of the preservation of nature which obtains to-day throughout the Continent of Europe owes its inception generally to the action of the National Trust.

In the year 1899 Mr. Moberly purchased and presented to the National Trust, for permanent preservation, a few acres of Wicken Sedge Fen, and this, I believe, was the first attempt to preserve for posterity an area of uncultivated land in the British Islands with a view to the preservation of its fauna and flora.

In 1901 the late Mr. Henry Willett, of Brighton, hearing of this gift, purchased and presented to the Ashmolean Natural History Society of Oxfordshire an area of land now known as the "Ruskin Reserve," Mr. Willett being desirous that Oxford as well as Cambridge should be possessed of a nature reserve. This land, which was really selected by my friend, Mr. G. C. Druce, is now held in trust for the benefit of the nation by him and Professor Poulton.

About the year 1894, the German Government, finding that the fauna and flora of that country were yearly diminishing, started a Department of State, with a view to preserving areas of land all over the German Empire so that adequate representatives of the German fauna and flora should remain for posterity. The Director of this Department, Professor Dr. Conwentz, has not only established a truly wonderful system for the preservation of the fauna and flora of Germany, but has instilled the desirability of this object into a number of other European countries with quite remarkable results, which I propose to refer to again in a later portion of this address.

It is necessary to mention at this point several other Societies which have been doing excellent work with regard to the preservation of the big game inhabitants of the globe: The Society for the preservation of the Fauna of the Empire, the Zoological Society of London, and others; it is generally owing to their efforts that the splendid series of big game reserves in Africa, India and some other places have been established.

Finally, I would bring to your notice a comparatively new society, the Society for the Promotion of Nature Reserves, whose object is to further this laudable purpose in every way it can. It is much to be hoped that the efforts it has been and is making will be successful, and they are efforts which especially appeal to the Fellows of the Entomological Society, as I am convinced that it is only by means of nature reserves carefully selected and representing all types of country in the British Islands that anything like a large proportion of the insects that inhabit this island to-day can be preserved for posterity.

The Commons Preservation Society may also be cited as an illustration of a society whose objects are not primarily directed to the preservation of animals and plants, but whose excellent action in preserving commons tends to secure this end.

I have now, gentlemen, outlined to you in a very brief, and, I fear, possibly perfunctory manner, the growth of the idea of the desirability of preserving nature and of effecting this object by means of the so-called nature reserve. We have seen that a nature reserve is an area, perhaps small, perhaps large, which is kept, as far as it is possible to do so, in its natural wild condition, with a view to the fauna and flora within the area flourishing undisturbed. With all the changes that are continually going on round the area in question, it is doubtful whether it can really be kept in its natural state, but to some extent this object can doubtless be attained.

Small areas surrounded by land under cultivation or by pastures cannot be turned into nature reserves simply by leaving them waste. The conditions under which such a small area would exist are quite artificial, and the result would be that certain species of plants would swamp the others.

This applies also to the open areas in forests. A good spot for Lepidoptera may become entomologically worthless in consequence of the place becoming overgrown with a dense mass of hazel, elder, aspen and other shrubs and trees which grow rapidly. A control is necessary. In such small areas the fauna should also be under control, as there is always the danger that certain species may become so numerous as to be a serious danger to the weaker members of the fauna. An excess of blackbirds and thrushes in a shrubbery will keep out other birds, and the fostering of large numbers of tits may lead to the extermination of certain insects. If the areas are large, these dangers are not likely to obtain.

We are only at the beginning of science; it is doubtful if the human race will ever get very far advanced in the knowledge of the physical, chemical and biological problems which obtain on this planet. But one thing is certain, that the study of plant ecology and of the ways in which animals (the word being used in its widest sense) flourish among their own surroundings, is of vital importance to the human race. Farmers have known for a vast period of time that clover is a good rotation crop to grow where wheat is cultivated. It is, however, only quite recently that the reason of this has been understood. Doubtless if the connection of plant and animal association were better understood than it is to-day, the advantages to the human race would be incalculable. Year by year, as wild life is destroyed, the opportunities for the study of this problem are restricted. I feel confident that if ever a number of nature reserves are established, the good that will come to mankind from their establishment will be quite out of proportion to what is at present expected from them. We have to think of posterity, we have to think of education. For both these purposes the nature reserve is of value. And the camera should not be forgotten. Photographs of nature reserves as they look from year to year will be of immense value to the future student.

Two years ago there was an International Congress at Berne to discuss the international protection of nature. I was deputed by the British Government to attend that Congress, and no less than thirty-five delegates were present,

representing nineteen countries. This fact alone demonstrates that the desirability for the protection of nature is being realised.

I will now attempt to lay before the Fellows of the Entomological Society of London some aspects of the preservation of nature as they apply especially to entomology. It is impossible to separate entirely entomology from its sister science botany. If there were no plants, there would be no lepidoptera, and therefore in reviewing the problems of the preservation of the fauna and flora of any country, and in all countries, plants and insects must to some extent be regarded together. An ideal system of nature reserves would be one which embraced adequate reserves all over the globe, and if a scheme was to be thought out for protecting nature in the British Islands, a narrow view should be avoided. We ought to "think imperially," as Mr. Chamberlain once said, and such reserves should be selected as represent types of vegetation which either do not exist on the Continent of Europe, or which are not, at the present day, so well represented there. If this course were followed in every country of Europe, a series of reserves would be created and maintained illustrating the fauna and flora of Europe as it exists to-day. The Executive Committee of the Society for the Promotion of Nature Reserves has been engaged for some considerable time on framing schedules of areas in the British Islands, which, in their opinion, would, if properly preserved, exhibit the characteristic types of wild country which still obtain. If we consider what species have disappeared in the British Islands to the greatest extent, we may be able to judge what types are likely to disappear in the future most rapidly. Unquestionably, at all events among lepidoptera, and probably in most orders of insects, it is the fen and marsh species which have disappeared from the British Islands in recent times. Had Whittlesea Mere been made into a nature reserve in the early 'forties, we should, without question, have had the moths *Loelia coenosa* and *Agrotis subrosea* still among us. The plants which have become extinct in this country are also for the most part species frequenting marshy localities. The Great Marsh

ragwort, the Marsh Fleabane, *Eriophorum alpinum* and *Carex davilliana* are all species attached to moist situations. Perhaps the most characteristic types of country which obtain in the British Islands to-day are the sand-dunes, the shingle-beaches, and the salt marshes. There are still large areas of each of these three types left, though golf has sadly interfered with the first-named, and it is among the salt marshes of England that perhaps our most interesting species are found. *Epicnopteryx retiella* only occurs in Great Britain and Holland. Its only near ally comes from the Steppes of Hungary and Russia. It is a truly wonderful insect, and every effort should be made to protect it. *Leucania favicolor* is, as far as I know, confined to this country, while *Agdistis bennetti* appears, so far, to have been recorded only from England, Holland and France, though perhaps it has a wider distribution. It is these local insects which still occur, and occur fairly commonly, in the British Islands which we should endeavour to protect. One or more areas of salt marsh should be acquired and permanently preserved. The tiny *Goniodoma limoniella* is confined to this country, and so are several other micros inhabiting salt marshes, though it is more than probable that, were they searched for in Holland and France with the same assiduity as has been bestowed on them in this country, they would be found to occur also on the Continent of Europe. The Norfolk Broads, harbouring, as they do, *Papilio machaon* and *Nonagria brevilinea*, which latter is confined to the British Islands, is another instance of an area which should never be allowed to be destroyed. In Wales *Agrotis ashworthii* and *Acidalia contiguaria* offer another field for the establishment of a reserve, while one or other of the chief haunts of the Large Blue should also be acquired.

There are many plants which it is more than desirable should be preserved, and this can only be effected by offering adequate protection to the spots where they grow. A law, were it to be passed, absolutely forbidding any one to pick or interfere with one or the other of the rarer orchids would not benefit that plant in the least, were the ground where it obtains ploughed or planted with larch trees, a fate which is more than likely to await some of our already disappearing

species. The Lady's Slipper, perhaps the most charming of our wild flowers, is on the verge of extinction, not only in Great Britain but in many other countries on the Continent of Europe. It may be incidentally remarked that its protection in Denmark owes its inception to a wealthy brewer, who purchased the area where the plant grows, and presented it to the State. If it still occurs in one or the other of the situations in England where it is alleged to have formerly been found, one can only hope that a similar fate may await it in this country. At the meeting at Berne for the International Protection of Nature, my friend, Mr. Charles Oberthür, of Rennes, pointed out that there were several European species of butterflies whose protection was most desirable. Among those that he mentioned are *Erebia christi*, found in a valley south of the Simplon; *Plebeius lycidas* in the Simplon; and *Nemophila cervini* from the Valais. *Parnassius apollo* has already received protection in Germany. Its disappearance, however, from at least one of the localities where it was formerly found is due, not so much, if at all, to the collector, as to the afforestation of the area. Now, had this area, a small one, been made into a reserve with proper supervision, the result mentioned above could not have obtained. In Hungary several of the rarest species are in danger of destruction, especially those which occur in the big plain. It is pleasing to note that 400 acres of the great sandy plain close to Servia have been reserved, and an effort is also being made to preserve some seven acres in the well-known Puszta-Peszer.

Turning now from Europe to the Tropics, some hesitation may be felt as to the necessity of establishing reserves. The Fellows of The Entomological Society of London should be assured that there is an equal necessity here. In a country like Ceylon, where the virgin forest of the lower altitudes is decreasing at a rapid rate, the danger of the entire destruction of the fauna and flora which are found in that portion of the country which is below 4000 ft. is a very real one, and, with its disappearance, many problems of the highest interest could not be studied and properly solved. In Java, in the neighbourhood of Buitenzorg, a considerable area of virgin forest has been retained, and experiments carried on there by

entomologists concerning dimorphic forms of *Papilio memnon* have led to results of prime importance. In the smaller islands, such as, for example, the Solomon Islands and the Mascarene Islands, where some of our most interesting insects and plants occur, the gradual development of the areas in question must destroy the native fauna and flora, if adequate protection is not provided by the establishment of reserves in these localities.

I now propose to lay before the Fellows of the Entomological Society some notes about the preservation of nature in various countries, looking at the problem geographically. I trust that the Fellows will permit me to show them some slides illustrating some points upon which I propose to touch.

In Great Britain we have The Society for the Promotion of Nature Reserves and The National Trust, and also The Society for the Preservation of Commons. We are all working on similar lines, though The Society for the Promotion of Nature Reserves is the only one whose primary object is to protect nature for the sake of its fauna and flora alone. I suppose the most interesting reserve we have in the British Islands is that of Wicken Fen. The first step towards the acquiring and preservation of this area was taken by Mr. Moberly many years ago. Since that date our lamented President, Mr. Verrall, succeeded in acquiring and handing over to The National Trust a sufficient area of this locality to insure its permanent preservation. The National Trust has also acquired some thirty acres of Adventurers' Fen, which, though not a sedge fen, and not resembling Wicken Fen in its general vegetation, is of very considerable interest to the entomologist, exhibiting, as it does, some remarkable reed growths. I must also mention Wood Walton Fen, which is a nature reserve kept by a private owner. This place, which is of real botanical but slight entomological interest, is certainly a desirable spot. The Society for the Promotion of Nature Reserves recently acquired and handed over to The National Trust the lease of a small area in the Midlands of quite exceptional interest. It is the home of several rare orchids, some other plants of very great interest, and also of some rare insects. It is much to be hoped that this area, small as it is, may be preserved for posterity. We also must

not forget to mention Box Hill, which, by the munificence of a private person, unfortunately recently deceased, has been preserved for the nation. There is probably no locality in Europe to-day where box trees can be seen to such advantage. Box Hill is a reserve of which any country might be proud.

I would then like to mention Blakeney Point, that strange excrescence of the Norfolk coast some thousand acres in extent, which has been recently acquired by The National Trust. Blakeney Point has not been thoroughly worked entomologically, but there can be little doubt that it preserves to no small extent many of our interesting coast species, and is also of considerable interest to the botanist and the ornithologist. It is, I believe, the most southern point at which that curious plant known as the Oyster Plant, or *Mertensia*, obtains, and visitors to the spot in question will do well to train their eyesight by trying to detect this plant among the shingle when it is not in flower. Several places in the Lake District have also been acquired and preserved by The National Trust. I am venturing to submit some pictures of them to my audience to-night, and, although these places are not of special interest to the entomologist, they are most desirable areas. I should also like to mention Hindhead and Coombe Hill. Coombe Hill, near Wendover, is a decidedly interesting entomological locality, and its dedication to the public as an open space is a great blessing. Finally, I would call the Fellows' attention to, perhaps, the most marvellous area which still exists in England, that is, Kingley Bottom, near Chichester, the property of the Duke of Richmond. This is a virgin yew forest of some hundreds of acres, and is, I believe, the only virgin yew forest in Europe. It is preserved by the owner, and I venture to bring before the Fellows to-night several photographs of it, and I think we can justly say that probably there is no reserve in any part of Europe of greater beauty and interest than this area. I trust the Fellows will permit me to bring before them some coloured plates illustrating a few of the plants which the Society for the Promotion of Nature Reserves is desirous of preserving. The last few which I propose to exhibit are plants which are more or less confined to Wales, as regards the British Islands. It

is much to be hoped that the places where they grow will some day be secured for the nation.

Turning to our Crown colonies and self-governing colonies, I would like to call the Fellows' attention to the wonderful efforts which Canada has made to preserve its native fauna and flora, efforts which should certainly be emulated by other countries. These reserves are managed partly by the Dominion Government and partly by the Provincial Governments. The Dominion Government appropriates a sum of £130,000 a year for their adequate upkeep. Statistics are generally dull; I am nevertheless venturing to put these facts before the Fellows, and to show them at the same time some photographs of these areas. My friend, Dr. Gordon Hewitt, of "Kill that fly" fame, takes a great interest in this movement, and Canada is much to be congratulated on having his sympathy.

DOMINION PARKS

	Sq. miles
Rocky Mountain, Banff, Alberta	1800
Yoho, Rocky Mountains	560
Glacier, Rocky Mountains	468
Jasper Park, Rocky Mountains	1000
Waterton Lake Park, Alberta	13½
Buffalo Park, Yellow Head, Alberta	162
Elk Island Park, Alberta	16
Thousand Island Park, St. Lawrence	
	Acres.
Stanley Park, Vancouver	1000
	Sq. miles.
Moose Mountain Reserve, Alberta	2

PROVINCIAL PARKS

	Sq. miles.
Algonquin Park, Ontario	2300
Temagami Park, Ontario	
Queen Victoria Park, Niagara Falls, Ontario	
Rondeau Park, Ontario	8
Laurentides Park, Quebec	3700
Mount Robson Park, British Columbia	
Strathcona Park, Vancouver Island, British Columbia	

I may mention incidentally that the buffaloes in Buffalo Park are preserved on an area which consists largely of prairie, so that the preservation of the buffalo on this land not only preserves that animal, but also a considerable area of virgin prairie land, which, in the United States of America, is already difficult to find. To most of us who have read Fenimore Cooper's books, or perhaps "The Adventures of M. Valerie," it is difficult to believe that a sample of those vast prairies is hard to discover; but when a party of botanical ecologists not long ago visited the United States, they had great difficulty in discovering a suitable area. Another of our Dominions which has made mighty efforts to conserve its fauna and flora is the Dominion of New Zealand. The Dominion of New Zealand has several special reserves set apart for their birds, such as Stewart Island. But in addition to this they have a preservation of Scenery Department, which has really effected wonderful results. Up to the 31st of March last year New Zealand possessed 430 reserves, embracing an area of 274,000 acres. Here, again, the areas which have been preserved have been selected primarily for their beauty, but the native fauna and flora have incidentally been preserved also, while a private Society, The New Zealand Forest and Bird Protection Society, modelled on The Society for the Promotion of Nature Reserves, is endeavouring to get similar areas, which are the haunts of specially rare and vanishing species of plants and insects, secured for permanent preservation. When it is considered that New Zealand is more or less the same size as Great Britain, it is much to be regretted that the area of our own reserves is not proportionately as large. The Government has already spent more than £100,000 in achieving these ends. Tasmania has reserved certain localities, possessing remarkably fine scenery and waterfalls, some 7,500 acres in extent. South Australia has ten bird-protection districts, aggregating 108,000 acres, and three reserves for fauna and flora containing 96,000 acres. One of these, the National Park of Belair, embraces 2000 acres. In Western Australia, King's Park and Mount Eliza near Perth, 1000 acres, are reserved, and 160,000 acres in the Murray District. There is also a further reserve for

the protection of caves and flora in the County of Sussex in Western Australia, amounting to about 12,000 acres. In the Swan District of Western Australia 5,600 acres have been reserved, also several lakes, islands, and river estuaries, and there is a kangaroo reserve. In the Island of Ceylon there is a game reserve of 362 square miles. Here, again, big game is the primary object of the reserve, but the native forest is incidentally conserved.

Turning now to the United States of America, we find that a real effort has been made to preserve the native fauna and flora. The various reserves are under the jurisdiction of five government departments, the Smithsonian Institution and the District of Columbia. The majority of the reserves, however, are administered by the Board of Agriculture. There are fifty-six national bird reserves in the United States, and ten more reserves bring the total up to sixty-six, the last-named being specially for aquatic species. The total area reserved in the United States is five million acres, of which the well-known Yellowstone Park consists of about two million acres, Yosemite Valley in California is 720,000 acres, and Glacier Montana 915,000 acres. The United States are making a special point of trying to preserve adequate breeding-grounds for aquatic birds, these reserves also incidentally preserving marsh plants and insects.

South America, too, has not been behind in the establishment of nature reserves. There are two of considerable interest in the Argentine Republic, which, strange to say, have not received the attention they deserve. The first of these was established in the year 1902 by Mr. Charles Thays, a wealthy man who wished to present the Republic of Argentina with a memento suitable to his memory. Why he thought that the magnificent falls of Iguazú and the surrounding country, some 50,000 acres, were really suitable to remind the inhabitants of Argentina of his personality, I cannot say, but no doubt he had good reasons. However, the country is enriched by the possession of this magnificent reserve of 50,000 acres. The Falls of Iguazú are close to the boundary between Argentina and Brazil. The second national reserve in the Argentina, which is situated on the boundary between

Argentina and Chile, is the National Park of Nahuel Huapi, which is at the extreme southern point of the district of Neuquen in the Patagonian Andes. Quite different from the previously mentioned tropical reserves, this represents a temperate climate, and is 430 square kilometres in size. It was mentioned as a remarkable place as long ago as 1690 by the Jesuits of Chile.

Turning now to the European Continent, we find that many countries have made a real effort to preserve their fauna and flora. As we have pointed out, among European countries, England took the initiative in the year 1884, and in the early 'nineties Germany followed with the government department to stimulate the protection of nature, and to carry into effect the preservation of many interesting areas. Professor Conwentz, the director of this Government department, made great efforts to secure the subject being taken up in the Scandinavian countries, with the result that Denmark, Norway and Sweden have endeavoured to follow the good example of Great Britain, and to establish reserves. Norway has three reserves; they are all in forest areas, and they have also preserved some waterfalls. The preservation of waterfalls in Norway is very desirable, as most of them in that country are used for the generation of electrical power. Curiously, it is the action of damming up the rivers for the production of electrical power that is causing the rapid reduction in the numbers of the beaver. Of the three areas that are already reserved in Norway, one consists of about 1,100 acres, and one of 10,000 acres. The latter, which is situated at a place called Famundsee, contains some remarkable yew trees, which are possibly not far inferior in size to our yew trees in Kingley Bottom.

Denmark has also endeavoured to establish some reserves. One of these, consisting of about three to four thousand acres, is a heath of very considerable interest, while the so-called Raabjaerg Mile, a large sand-dune of some 450 acres, is carefully preserved in the neighbourhood of Skagen. Some smaller reserves in Denmark for the preservation of old coast-lines, and the so-called Devil's Wood on the sea-coast, where the trees have been destroyed by the invasion of sand, are also interesting.

Sweden is well in the fore in the preservation of nature, and has made great and astonishing efforts to secure this end. They have a government department which has made and is making every effort to secure the preservation of their fauna and flora. The well-known naturalist, A. E. Nordenskiöld, urged, as long ago as 1880, the desirability of establishing national parks, which he called " Pictures of nature for the future," and he further urged the desirability of affording protection to sea-birds, water-lilies, and that most interesting plant, the Water-nut (*Trapa natans*). This plant, which has, even to-day, a very wide distribution taking in various local races, extending from Sweden to China, is disappearing all over the world, chiefly owing to drainage. There is strong reason to believe, from the examination of peat deposits, that it once flourished in England, and in comparatively recent times. It certainly did so in Holland, where it is now extinct, but it still lingers in Sweden, in Germany, in one locality in Hungary, in France, and in some other countries. Nordenskiöld's efforts were not altogether crowned with success, but at a later date the Government and the universities started working together, and they have classified the various wild areas that exist in Sweden in order that an adequate selection of reserves can be made. They, further, have endeavoured to secure the co-operation of private owners to frame laws for the protection of species, and to establish reserves. Expropriation can even be employed in certain cases. The result of the joint endeavours of the universities and the Government of Sweden has been to establish ten national parks, the five largest of which are in the north, and the other five in the centre of Sweden. The areas embraced are really very large, and there is no doubt that Sweden possesses the largest area of nature reserves of any European country. The largest of the Swedish national parks is Sarjek National Park, which is 500 square miles, while the Stora Sjöfallet and the Abisko National Park are some 300 and 100 square miles respectively.

The next European country I should like to mention is Switzerland. The Swiss have shown their usual energy and sagacity in making national reserves. The prime mover in

this laudable object is my friend Dr. Paul Sarasin. The Swiss have established a national park at Val Cluosa in the Engadine, towards the Tyrol border, of 50,000 acres. The beauties of this spot alone make it worth a visit. Here the magnificent Alpine flora of Switzerland flourishes unmolested, while eagles and chamois are quite common. The red deer, which was extinct in Switzerland at the time the park was established, have come across out of Austria and are now forming a flourishing and increasing colony within the sanctity of the Swiss National Park. The Swiss have also a number of smaller reserves. In many of the forests an effort has been made to keep some portions in their natural state, and especially fine growths of clematis and other plants which modern forestry destroys are preserved in certain areas.

In Holland an effort has been made to preserve certain marsh areas, an effort we all greatly appreciate. The Naarden Lake, the Lake of Oisterwyk, and the Island of Texel are all reserves primarily for birds, but there can be no doubt that the first and last-named must harbour many interesting insects, and it is much hoped that collectors will visit them and ascertain what fine species still exist there. Although I am not aware in which part of Holland the discovery was made, we all know that the Large Copper still exists in that country, and it is much hoped that the locality where it obtains will be preserved in perpetuity.

France has two large reserves; one is the well-known forest of Fontainebleau, an area somewhat analogous to our New Forest, and I must confess that I deplore that the various Acts that have been passed from time to time regulating the government of our New Forest were not made sufficiently comprehensive to secure the permanent preservation in its original state of all that area, as has been effected by France in the case of the forest of Fontainebleau. There is also a further large reserve of 25,000 acres in the Department of Isère, called the Cirque de la Berarde. The preservation of nature and the establishment of national parks is in the hands of a Government Department, but we must not forget the forest of Chantilly, which, if not a nature reserve in the true sense, is still managed by the Institute on lines more or less keeping

it in its natural condition, a joy to the tourist and entomologist alike.

Russia has established at least three nature reserves; one of them in Lithuania, for the preservation of the almost extinct European bison. There are two other reserves specially for plants with a view to preserving the Steppe flora of Russia. One is about 1,200 acres, and the other 1000 acres. The Steppe flora of Russia is of such a remarkable nature that one cannot but rejoice that the Russian Government has taken steps to preserve a portion of it in perpetuity.

Austria has several nature reserves, which owe their inception to private individuals, and very remarkable reserves they are. Two of these are in the well-known Böhmer Wald. The third is the perhaps less well-known Kubani. This is a reserve of some 250 acres, and the previous owner of the property had placed a note in his will that these 250 acres should be left in their natural condition so that persons visiting the estate should see the advantages of properly conducted forestry. In that way a valuable nature reserve was established. The fourth nature reserve, also about 200 to 300 acres, belongs to a connection of mine in Dürnstein in Upper Austria. It is a virgin pine forest known as the Rothe Wald. The area in question was not put to any economic use on account of its great distance from a road, and was bought by my relative many years ago on account of its natural beauty, and he has retained it in its primitive condition. The preservation of nature in Austria has been furthered in recent years by a private society, which has secured a remarkable area in the Salzburg region which is called the Austrian National Park. It is in the mountains known as Hoher Tauern, and is about 46 square miles. It is proposed to make others. I am venturing to show the Fellows to-night some pictures of this reserve, which are quite surprising in beauty. A similar Society obtains in Germany, which has acquired a large area of the well-known heath, the Lüneburger Heide. They not only endeavour to protect the uncultivated portions of this area, and have done so with considerable success, but they also protect

some old peasants' houses and some of the ancient customs that formerly obtained in the district. The photograph I show the Fellows to-night of the Beehives in this area is truly remarkable.

They have a large number, some hundreds, of nature reserves spread about in different places. In the Bavarian Alps is a reserve of 16,000 acres. I propose to lay before the Fellows to-night some photographs of some of these.

In concluding these few remarks to-night, I have merely to add that I wish to thank the Fellows of The Entomological Society of London for having elected me to be their President, and to assure them how greatly I appreciate that honour. I trust that these few words about the preservation of nature may have been of some small interest. I desire to tender my best thanks to certain persons and firms who have permitted me to make use of some of their pictures which are copyright; these are Mr. E. A. Porter, of 7, Prince's Street, Cavendish Square; The Royal Society for the Protection of Birds; and Messrs. Frederick Warne, Chandos House, Bedford Street. Strand.

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S.P.N.R. Poster.

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REPORT OF THE BRITISH NATIONAL COMMITTEE ON ENTOMOLOGICAL NOMENCLATURE

REPORT OF THE BRITISH NATIONAL COMMITTEE ON ENTOMOLOGICAL NOMENCLATURE.

The National Committees on Nomenclature owe their existence to the action of the second International Congress of Entomology held at Oxford in 1912, which pronounced unanimously in favour of their creation in consequence of a resolution put before it by the Entomological Society of London, by whom it had been adopted at their meeting on June 5th, 1912 (Proc. Ent. Soc. **1912.** p. lxv–lxvii). The formation of these National Committees was entrusted to the Entomological Societies of the different countries (Proc. 2nd Int. Congr. Ent. **1.** p. 119–121), and the Entomological Society of London was invited, through its Council, to nominate at first two, and afterwards three, members of the British Council. The recommendations of the Council were adopted by the Society at their meeting on March 5th, 1913 (Proc. Ent. Soc. **1913.** p. xiii), and it was at the same time resolved to form a permanent Committee of their own, consisting of the President and one of the Secretaries of the Society, their three members of the National Committee, the British member of the International Committee and two elected members. As the only member of the National Committee elected by any other British Society (the Birmingham Entomological Society) had already been elected as one of their unofficial members by the Entomological Society of London, the Committee formed by the latter eventually became and was recognised as the "British National Committee of Entomological Nomenclature."

The duties assigned to the International Committee by the Congress were :—

To collect, in co-operation with the National Committees,

the opinions of entomologists on questions of nomenclature as affecting Entomology;

To consider what elucidations, extensions, and emendations, if any, are required in the International Code;

To confer with the International Commission on Zoological Nomenclature; and

To lay a Report on these points before the next Congress of Entomology (Proc. 2nd Int. Congr. Ent. **1.** p. 120).

In pursuance of its own part of this work, the British Committee has held several meetings, considered a number of questions submitted to it, and given opinions thereon, which are detailed in the following Report.

REPLIES TO QUESTIONS SUBMITTED TO THE COMMITTEE

Question 1.—(J. E. Collin.)

Haliday (1833) described a new genus Heleodromia with four new species: Group A, **H. immaculata;** Group B, *H. bipunctata*, *stagnalis*, and *fontinalis*, but fixed no species as the type of the genus.

Curtis (1834), without splitting up the genus, gave: "Type of the genus **H. immaculata** Hal."

Macquart (1835), without any personal knowledge of any of the species, split up Haliday's genus, retaining the name Heleodromia for the Group A of Haliday (**H. immaculata**), and proposed a new generic name Hydrodromia for *H. bipunctata* and *stagnalis* (but made no mention of *fontinalis*).

Haliday (1840) wrote: "Macquart has divided Heleodromia into two genera, but the name should be retained for the second division;"—"the name applying to the aquatic habits: (has not Hydrodromia been employed among *Crustacea*?). I would propose to substitute Sciodromia as the generic name of the first division."

Ever since 1840 Haliday has been followed and not Macquart, the generic name Sciodromia being used for **immaculata,** and Heleodromia for *stagnalis* and *fontinalis*.

What is the type of the genus Heleodromia?

Has HYDRODROMIA any standing as a genus, considering that its author had never seen either of the possible types?

OPINION 1.—The Type of HELEODROMIA Haliday (1833) was fixed as **immaculata** Haliday by Curtis (1834), and by Macquart (1835); *SCIODROMIA* Haliday (1840), Type **immaculata** Haliday (Haliday, 1840), is a synonym.

HYDRODROMIA Macquart (1835) n.g. [= * *Heleodromia* Haliday (1833)—Group B. sp. 2–3); = * *Heleodromia* Haliday (1840)]. The Type is either *bipunctata* Haliday, or *stagnalis* Haliday, and for either of these HYDRODROMIA Macquart is a potentially valid genonym.

Signed: *G. T. Bethune-Baker; Jno. Hartley Durrant; C. J. Gahan; K. Jordan; Louis B. Prout; Chas. O. Waterhouse; George Wheeler.*

Result, $\frac{7}{7}$: all concur.

QUESTION 2.—(J. H. Durrant.)

Stephens [Ill. Br. Ent. Haust. **4.** 119 (1834)] wrote thus of CARPOCAPSA Tr.:—

"This genus requires considerable revision; the three first species" [*i. e.* 1. **pomonella** L.; 2. *splendana* Hb.; 3. *grossana* Hw.] "form the true *Carpocapsae* of Treitschke—*Cydia* of Hübner—the remainder are mostly included in the genus *Grapholitha* of Treitschke, and constitute other genera of Hübner, as indicated hereafter."

The only species common to Hübner and Stephens, and which was therefore regarded by Stephens as the Type of CYDIA Hb., is **pomonella** L.

Are we to consider that Stephens states the case thus:—

CARPOCAPSA Tr. (1829) = CYDIA Hb. (1826), Type **pomonella** L., with which *splendana* Hb. and *grossana* Hw. are alone congeneric?

[Curtis, Br. Ent. **8.** expl. Pl. **352** sp. 1–24 (1831), cited **pomonella** L. as the Type of CARPOCAPSA Tr., and Walsingham, Pr. Z. Soc. Lond. **1897.** 130–1 no. 69 sp. 182 (1897), adopted Stephens' restriction and cited **pomonella** L. as the Type of CYDIA Hb. also.]

Opinion 2.—Stephens' words can have but one meaning:—
Cydia Hübner (1826) = *CARPOCAPSA* Treitschke (1829), Type: **pomonella** Linné.

Signed: *G. T. Bethune-Baker; Jno. Hartley Durrant; C. J. Gahan; K. Jordan; Louis B. Prout; Chas. O. Waterhouse; George Wheeler.*

Result, $\frac{7}{7}$: all concur.

Question 3.—(K. Jordan.)

X proposed a name for a supposed species closely allied to another species: he does not know which of these species has been already named, and wishes his new name to be applied to the one which has no name.

What is to be done with the new name proposed by X?

Opinion 3.—A valid name can only be applied to a definite conception (rightly or wrongly formed, but **definite** so far as the Author is concerned); X has formed no conception as to the particular species to which the new name is to be applied—there is therefore no Species nor Type to which the new name **can** be applied: this new name is a mere logonym absolutely invalid in nomenclature.

We regard the publication of such names as most reprehensible.

Signed: *G. T. Bethune-Baker; Jno. Hartley Durrant; C. J. Gahan; K. Jordan; Louis B. Prout; Chas. O. Waterhouse; George Wheeler.*

Result, $\frac{7}{7}$: all concur.

Questions 4–26.—(G. T. Bethune-Baker.)

"I beg to formally ask the National Committee on Nomenclature to consider and issue recommendations on the proposals suggested by Roger Verity in the J. L. S., Vol. XXXII. p. 173 *et seq.*" (G. T. B-B.)

[For the convenience of the Committee :—

Verity, Roger : "Revision of the Linnean Types of Palaearctic Rhopalocera."

Jr. Linn. Soc. Lond. Zool. **32.** 173–91. London, 16. V. 1913.

Jordan, Karl : "Observations on certain Names proposed in Dr. Verity's paper on the Rhopalocera Palaearctica in the Collection of Linnaeus."

Jr. Linn. Soc. Lond. Zool. **32.** 193–4. London, 16. V. 1913.

Bethune-Baker, George T.: "Observations on Dr. Verity's Review of the Linnean Collection and his suggested Nomenclatorial Alterations."

Ent. Rec. **25.** 251–3. London, 15. X. 1913.

Bethune-Baker, George T.: "Further note on Dr. Verity's Linnean suggestions."

Ent. Rec. **25.** 272–3. London, 15. XI. 1913.

Wheeler, George : "A Critical Examination of Dr. Verity's paper on the 'Types' of Palaearctic Rhopalocera in the Linnean Collection."

Ent. Rec. **26.** 29–35. London, 15. II. 1914.

Durrant, John Hartley : "*Papilio podalirius* Linné (= *sinon* Poda)."

Ent. Rec. **26.** 70–2. London, 15. III. 1914.]

Question 4.—(G. T. Bethune-Baker.)

Can the name *Papilio podalirius* Linné (1758) stand as against *Papilio sinon* Poda (1761)?

Opinion 4.—When Linné [Syst. Nat. (ed. **10**) **1.** 463, *footnote* (1758)] cited "Raj. ins. 111. n. 3," he furnished a careful description, to which description, and to the descriptions and figures by Roesel ("Roes. ins. 1. pap. 2. t. 2") and Réaumur, he applied the name **Papilio podalirius** L. (1758).

Signed : *G. T. Bethune-Baker ; Jno. Hartley Durrant ; C. J. Gahan ; K. Jordan ; Louis B. Prout ; Chas. O. Waterhouse ; George Wheeler.*

Result, $\frac{7}{7}$: all concur.

Question 5.—(G. T. Bethune-Baker.)

To which geographical form of *Papilio podalirius* Linné did Linné apply the name "*podalirius*," or to which form was the name "*podalirius*" first definitely applied?

Opinion 5.—Scopoli [Ent. Carn. 167 sp. 445 (1763)] was the First Reviser of the works of Linné and Poda. He sunk *sinon* Poda as a synonym of **podalirius** L., Scp., and therefore was the first to determine the application of this name to the form figured by "Roesel, Papil. Diurn. Cl. II. Tab. 2. fig. 3. 4."

Linné [Syst. Nat. (ed. **12**) **1**(**2**). 751–2 sp. 36 (1767)] confirmed this decision by adopting Scopoli's synonymy and describing the species as "*flavescentibus*."

Signed: *G. T. Bethune-Baker; Jno. Hartley Durrant; C. J. Gahan; K. Jordan; Louis B. Prout; Chas. O. Waterhouse; George Wheeler.*

Result, $\frac{7}{7}$: all concur.

Question 6.—(G. T. Bethune-Baker.)

Are we to consider that Swedish specimens of "*rapae*" represent the form to which the name *Papilio rapae* Linné (1758) should be applied?

Opinion 6.—Linné's **Papilio rapae** [Syst. Nat. (ed. **10**) **1**. 468 sp. 59 (1758)] was a comprehensive term. The First Reviser was at liberty to restrict the name to which form he preferred.

Signed: *G. T. Bethune-Baker; Jno. Hartley Durrant; C. J. Gahan; K. Jordan; Louis B. Prout; Chas. O. Waterhouse; George Wheeler.*

Result, $\frac{7}{7}$: all concur.

Question 7.—(G. T. Bethune-Baker.)

Are we to consider the Central European "*napi*" as the form to which the name *Papilio napi* Linné (1758) should be applied?

Linné's **Papilio napi** [Syst. Nat. (ed. **10**) **1.** 468 sp. 60 (1758)] was a comprehensive term. This was first restricted by Esper (*c.* 1800), when he proposed the name *napaeae* (Eur. Schm. **1.** Fortsetz. 119 Pf. **116**·5) for what is now known to be the summer form. Ochsenheimer [Schm. Eur. **1**(**2**). 149–152 (1808)] dealt with these two forms and named a third form *bryoniae* (= *napi* Hb. Pf. **81**·407*).

Signed : *G. T. Bethune-Baker ; Jno. Hartley Durrant ; C. J. Gahan ; K. Jordan ; Louis B. Prout ; Chas. O. Waterhouse ; George Wheeler.*

Result, $\frac{7}{7}$: all concur.

QUESTION 8.—(G. T. Bethune-Baker.)

Are we to substitute "*brassicae brassicae* L." for "*brassicae chariclea* Stph." ?

OPINION 8.—No. Linné's **Papilio brassicae** [Syst. Nat. (ed. **10**) **1.** 467–8 sp. 58 (1758)] was a comprehensive term. The First Reviser was at liberty to restrict the name to which form he preferred.

Signed : *G. T. Bethune-Baker ; Jno. Hartley Durrant ; C. J. Gahan ; K. Jordan ; Louis B. Prout ; Chas. O. Waterhouse ; George Wheeler.*

Result, $\frac{7}{7}$: all concur.

QUESTION 9.—(G. T. Bethune-Baker.)

Are we to substitute "**belia** Linné" (1767) for "*euphaeno* Linné" (1767) ?

OPINION 9.—Yes. The case as stated by Verity [Jr. Linn. Soc. Lond. Zool. **32.** 178–9, 190 (1913)] is quite correct.

Signed : *G. T. Bethune-Baker ; Jno. Hartley Durrant ; C. J. Gahan ; K. Jordan ; Louis B. Prout ; Chas. O. Waterhouse ; George Wheeler.*

Result, $\frac{7}{7}$: all concur.

Question 10.—(G. T. Bethune-Baker.)

Are we to substitute "*Euchloë crameri* Btlr." in lieu of "*Euchloë belia* Cramer (*nec* Linné)"?

Opinion 10.—If **Euchloë crameri** Btlr. [Ent. Mo. Mag. **5.** 271 (1869)] is the oldest available name Dr. Verity's conclusions [Jr. Linn. Soc. Lond. Zool. **32.** 178–9, 190 (1913)] may be accepted.

Signed: *G. T. Bethune-Baker; Jno. Hartley Durrant; C. J. Gahan; K. Jordan; Louis B. Prout; Chas. O. Waterhouse; George Wheeler.*

Result, $\frac{7}{7}$: all concur.

Question 11.—(G. T. Bethune-Baker.)

Are we to substitute "*rhamni* L. *transiens* Vty." in lieu of "*rhamni*, South-European race"?

Opinion 11.—Linné's **Papilio rhamni** [Syst. Nat. (ed. **10**) **1.** 470 sp. 73 (1758)] was a comprehensive term. Subsequent Revisers were at liberty to deal with the races as they might prefer.

Signed: *G. T. Bethune-Baker; Jno. Hartley Durrant; C. J. Gahan; K. Jordan; Louis B. Prout; Chas. O. Waterhouse; George Wheeler.*

Result, $\frac{7}{7}$: all concur.

Question 12.—(G. T. Bethune-Baker.)

Are we to substitute "*cleopatra cleopatra* L." for "*cleopatra mauritanica* Röb."?

Opinion 12.—Linné says of **Papilio cleopatra** [Syst. Nat. (ed. **12**) **1**(**2**). 765 sp. 105 (1767)] "*Habitat in Barbaria*," therefore Dr. Verity is correct in his conclusions and is at liberty to apply the name *europaeus* Vty. to the South-European form, if this is required.

Signed: *G. T. Bethune-Baker; Jno. Hartley Durrant;*

C. J. Gahan; K. Jordan; Louis B. Prout; Chas. O. Waterhouse; George Wheeler.

Result, $\frac{7}{7}$: all concur.

Question 13.—(G. T. Bethune-Baker.)

Are we to substitute "*jasius* L. *septentrionalis* Vty." in lieu of "*jasius*, European race"?

Opinion 13.—Linné writes of **Papilio jasius** [= § *jason* L. Syst. Nat. (ed. 12) 1(2). 749 sp. 26; *jasius*, errata p. [36] (1767)] "*Habitat in Barbaria*," Dr. Verity is therefore right in applying the name to the North-African race, and is at liberty to name the European race—if a name be required.

Signed: *G. T. Bethune-Baker; Jno. Hartley Durrant; C. J. Gahan; K. Jordan; Louis B. Prout; Chas. O. Waterhouse; George Wheeler.*

Result, $\frac{7}{7}$: all concur.

Question 14.—(G. T. Bethune-Baker.)

Are we to substitute "*iris* L." for "*ilia* Schiff."?

Opinion 14.—No. We accept Dr. Jordan's statement of the case—Jr. Linn. Soc. Lond. Zool. **32.** 193–4 (1913).

Signed: *G. T. Bethune-Baker; Jno. Hartley Durrant; C. J. Gahan; K. Jordan; Louis B. Prout; Chas. O. Waterhouse; George Wheeler.*

Result, $\frac{7}{7}$: all concur.

Question 15.—(G. T. Bethune-Baker.)

Are we to accept "*pseudoiris* Vty." as a new name in lieu of "*iris* auctt."?

Opinion 15.—No. The previous decision settles this point.

Signed: *G. T. Bethune-Baker; Jno. Hartley Durrant; C. J. Gahan; K. Jordan; Louis B. Prout; Chas. O. Waterhouse; George Wheeler.*

Result, $\frac{7}{7}$: all concur.

Question 16.—(G. T. Bethune-Baker.)
Are we to substitute "*niobe niobe* L." in lieu of "*niobe eris* Meig."?

Opinion 16.—No. The original description of **Papilio niobe** L. [Syst. Nat. (ed. **10**) **1.** 481–2 sp. 143 (1758)] mentions "*maculis XIII argenteis*," and this settles the point that Dr. Verity's substitution is not justified.

Signed: *G. T. Bethune-Baker; Jno. Hartley Durrant; C. J. Gahan; K. Jordan; Louis B. Prout; Chas. O. Waterhouse; George Wheeler.*

Result, $\frac{7}{7}$: all concur.

Question 17.—(G. T. Bethune-Baker.)
Are we to substitute "*esperi* Vty." for "*adippe* auctt."?

Opinion 17.—No. The specimen now labelled "*cydippe*" and "*adippe*" in Linné's writing is **niobe** L. (N.B. not *eris* Meig.), but this does not tally with Linné's description of **cydippe** L. [Fn. Suec. (ed. 2) 281 sp. 1066 (1761); = *adippe* L. (1767), auctt.], having one more silver spot in the marginal row, and several between the central row and the basal spots, in addition to the "*maculis 23 argenteis*" mentioned in the original description. The only other specimen in the collection which can be Linnéan is a ♂ "*adippe*"; this tallies exactly with the description of **cydippe,** and may be that from which the description was made.

Linné described two different species under the same name "*Papilio cydippe*," viz.:—

1. **Papilio cydippe** L. Fn. Suec. (ed. 2) pp. [35], 281 sp. 1066 (1761). *Suec.*

2. *Papilio cydippe* L. Amoen. Ac. **6.** 409 sp. 76 (1763); Clerck Ic. Ins. **2.** Pf. **36**·1 (1764); L. Syst. Nat. (ed. **12**) **1**(**2**). 776 sp. 163 (1767)—"*Habitat in India.*"

In 1767 Linné noticed that he had given the same name to two different species, and he changed the name of the European species to *Papilio adippe* L. [Syst. Nat. (ed. **12**) **1**(**2**). 786 sp. 212 (1767)], remarking "*in Fauna Cydippe*

perperam pro Adippe legitur"; but Linné cannot be followed in this action, which is *ultra vires*, the European species having been published two years before the Indian. We must accept the following synonymy and sink *esperi* Vty. as a synonym.

Argynnis cydippe L.

Papilio cydippe L. (1761); = *Papilio adippe* L., nn. (1767), auctt.; = *Argynnis esperi* Vty. (1913).

Signed: *G. T. Bethune-Baker; Jno. Hartley Durrant; C. J. Gahan; K. Jordan; Louis B. Prout; Chas. O. Waterhouse; George Wheeler.*

Result, $\frac{7}{7}$: all concur.

Question 18.—(G. T. Bethune-Baker.)

Are we to substitute "*hermione* L." in lieu of "*alcyone* Schiff."?

Opinion 18.—Linné's **Papilio hermione** [Mus. Ludov-Ulr. 281 sp. 99 (1764)] was a comprehensive term. The First Reviser was at liberty to restrict the name to which form he preferred. Schiffermüller and Denis [Schm. Wien. 169–70 sp. 21 (1775)] separated **alcyone** S.-D., as a distinct species and restricted the application of **hermione** L. to *hermione* auctt. Dr. Verity's conclusions cannot therefore be justified.

Signed: *G. T. Bethune-Baker; Jno. Hartley Durrant; C. J. Gahan; K. Jordan; Louis B. Prout; Chas. O. Waterhouse; George Wheeler.*

Result, $\frac{7}{7}$: all concur.

Question 19.—(G. T. Bethune-Baker.)

Are we to substitute "*major* Espr." in lieu of "*hermione* (L.) auctt."?

Opinion 19.—No. The previous decision determines this point.

Signed: *G. T. Bethune-Baker; Jno. Hartley Durrant;*

C. J. Gahan; K. Jordan; Louis B. Prout; Chas. O. Waterhouse; George Wheeler.

Result, $\frac{7}{7}$: all concur.

Question 20.—(G. T. Bethune-Baker.)

Are we to substitute "*jurtina jurtina* L." in lieu of "*jurtina fortunata* Alphk." and "*jurtina janira* L." for "*jurtina jurtina* L."?

Opinion 20.—Linné's **Papilio jurtina** [Syst. Nat. (ed. **10**) **1.** 475 sp. 104 (1758)] was a comprehensive term. The First Reviser was at liberty to restrict the name to which form he preferred.

Signed: *G. T. Bethune-Baker; Jno. Hartley Durrant; C. J. Gahan; K. Jordan; Louis B. Prout; Chas. O. Waterhouse; George Wheeler.*

Result, $\frac{7}{7}$: all concur.

Question 21.—(G. T. Bethune-Baker.)

Are we to substitute "*maera maera* L." in lieu of "*maera monotonia* Schilde"?

Opinion 21.—Linné's **Papilio maera** [Syst. Nat. (ed. **10**) **1.** 473 sp. 96 (1758)] was a comprehensive term. The First Reviser was at liberty to restrict the name to which form he preferred.

Signed: *G. T. Bethune-Baker; Jno. Hartley Durrant; C. J. Gahan; K. Jordan; Louis B. Prout; Chas. O. Waterhouse; George Wheeler.*

Result, $\frac{7}{7}$: all concur.

Question 22.—(G. T. Bethune-Baker.)

Are we to substitute "*rubi rubi* L." in lieu of "*rubi borealis* Krul. (= *polaris* Möschl.)" and "*rubi virgatus* Vty." for "*rubi rubi* L."?

Opinion 22.—Linné's **Papilio rubi** [Syst. Nat. (ed. **10**) **1.** 483 sp. 154 (1758) was a comprehensive term. The First Reviser was at liberty to restrict the name to which form he preferred.

Signed: *G. T. Bethune-Baker; Jno. Hartley Durrant; C. J. Gahan; K. Jordan; Louis B. Prout; Chas. O. Waterhouse; George Wheeler.*

Result, $\frac{7}{7}$: all concur.

Question 23.—(G. T. Bethune-Baker.)

Are we to substitute "*virgaureae* L. *inalpinus* Vty." in lieu of "*virgaureae* L. Central European race"?

Opinion 23.—Linné's **Papilio virgaureae** [Syst. Nat. (ed. **10**) **1.** 484 sp. 161 (1758)] was a comprehensive term, but in the Fauna Suecica [(ed. **2**) 285 sp. 1079 (1761)] the only locality mentioned is "*in pratis Westmanniae,*" so the specimen from that locality may be taken as topotypical.

Signed: *G. T. Bethune-Baker; Jno. Hartley Durrant; C. J. Gahan; K. Jordan; Louis B. Prout; Chas. O. Waterhouse; George Wheeler.*

Result, $\frac{7}{7}$: all concur.

Question 24.—(G. T. Bethune-Baker.)

Are we to substitute "*hippothoë hippothoë* L." in lieu of "*hippothoë stieberi* Ger."?

Opinion 24.—The Type-locality for **Papilio hippothoë** Linné [Fn. Suec. (ed. **2**) 274 sp. 1046 (1761)] is Sweden "*Habitat apud nos rarissime.*" Specialists must decide whether *stieberi* Gerh. is identical with, or distinct from **hippothoë** L.—the same remark applies to *mirus* Vty.

Signed: *G. T. Bethune-Baker; Jno. Hartley Durrant; C. J. Gahan; K. Jordan; Louis B. Prout; Chas. O. Waterhouse; George Wheeler.*

Result, $\frac{7}{7}$: all concur.

Question 25.—(G. T. Bethune-Baker.)

Are we to substitute "*idas* L." in lieu of "*argyrognomon* Bergst."?

Opinion 25.—Linné described **Papilio idas** [Syst. Nat. (ed. **10**) **1.** 488 sp. 192 (1758)] with "*Habitat in Indiis.*" This must be regarded as a doubtful species, and § *idas* Linné [Fn. Suec. (ed. **2**) 284 sp. 1075 (1761)] is invalid as a homonym—**argyronomon** Brgstr. [Nomencl. Ins. **2.** 76 Pf. **46**·1–2 (1779)] cannot be affected by **idas** L. [Syst. Nat. (ed. **10,** 1758)] until this species ex "*Indiis*" has been identified with absolute certainty.

Signed: *G. T. Bethune-Baker; Jno. Hartley Durrant; C. J. Gahan; K. Jordan; Louis B. Prout; Chas. O. Waterhouse; George Wheeler.*

Result, $\frac{7}{7}$: all concur.

Question 26.—(G. T. Bethune-Baker.)

Are we to substitute "*ramburi* Vty." in lieu of "*idas* Ramb."?

Opinion 26.—*Polyommatus idas* Rambur [Fn. Ent. Andal. **2.** 266–8 Pf. **10**·5–7 [1840] is a homonym, a new name is therefore required for this species—**ramburi** Vty. [Jr. Linn. Soc. Lond. Zool. **32.** 189, 191 (1913)] should be accepted if valid.

Signed: *G. T. Bethune-Baker; Jno. Hartley Durrant; C. J. Gahan; K. Jordan; Louis B. Prout; Chas. O. Waterhouse; George Wheeler.*

Result, $\frac{7}{7}$: all concur.

Jno. Hartley Durrant,
Secretary.

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Report of the British National Committee on Entomological Nomenclature.

MEETINGS

TO BE HELD IN THE SOCIETY'S ROOMS

11, Chandos Street, Cavendish Square, W.

Session 1916–1917.

1916.

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